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The recent signing behaviour of chimpanzees (*Pan troglodytes*) in interactions with longtime human companions.

ESTEBAN RIVAS

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The recent signing behaviour of chimpanzees (*Pan troglodytes*) in interactions with longtime human companions.

een wetenschappelijke proeve op het gebied van de Wijsbegeerte

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Cover picture: Washoe sitting at the fence on the berm of the outdoor area, CHCI.

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Gimme gimme gimme a man after midnight.

Benny Anderson & Björn Ulvaes

Wörter machen nich Worte.

Johann Wolfgang Goethe

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PREFACE

This dissertation describes the scientific projects in which chimpanzees were taught signs with which to communicate. These studies were attempts to find out whether apes were capable of learning (a form of) human language. Starting in the 1960s, various chimpanzee subjects were taught communicative gestures which were based on the signs from the American Sign Language. The results of the research in the different projects, however, were often of a conflicting nature. The project leaders sometimes drew opposite conclusions on the chimpanzee signing behaviour. This situation led to what has become known as the ape language controversy. In this debate the different researchers contested each other's conclusions on the ability of chimpanzees to use signs in a linguistic manner. The author of this dissertation carried out a new study on the recent sign use of five chimpanzees at the Chimpanzee and Human Communication Institute in Ellensburg, Washington, which is directed by ape language researchers Roger and Debbi Fouts. The results of this study will be presented in this dissertation, along with the implications of these findings for the ape language debate.

In this preface I will describe the reasons why I set up a study with the signing chimpanzees. It will explain and help understand the background and purpose of this study. At the end of this preface, the contents of the various chapters in this dissertation will be presented.

I have always been interested in animals, whether they were human or nonhuman. As a psychologist and a philosopher I have been especially fascinated by the subjects of animal consciousness, animal cognition, and the philosophical discipline of animal ethics. In one of the first weeks of my academic education, during the first introductory courses of psychology, we were shown a movie that intrigued me. I believe it was called *Lullaby-baby.*

The film showed the similarities and differences between human and nonhuman animal behaviour. Included in this movie was a presentation of the research on the use of "sign language" by apes. It featured the first ape who was taught signs modeled after the American Sign Language: the chimpanzee Washoe. It was highly fascinating to see Washoe use signs to communicate with humans. Her behaviour inspired intriguing thoughts such as whether other animals were capable of a language like our own. More important to me was the possibility that apes, by using these signs, could be enabled to express their feelings and thoughts in explicit terms. This particular form of interspecific communication might tell us more about animal consciousness and the animal mind.

During the course of my studies I learned more about language experiments with nonhuman animals and my conviction grew that this was a too interesting area of research to be ignored. I also learned that a whole ape language controversy had emerged as the result of these experiments. The leaders of the different sign language projects with apes had quite opposite and contrasting conclusions on the apes' abilities and the arguments sometimes got rough and unpleasant. Not only were personal reputations of the researchers at stake, but there was also a considerable battle over age-old philosophical and scientific questions, such as the uniqueness of human language and the differing cognition and motivation of chimpanzees and human beings. The language experiments also had moral implications. There were questions such as what moral position nonhuman apes would have if they were shown to be capable of language and were thus not different in that respect from human apes. To me the major fascinating aspect of the language experiments was that we might obtain new knowledge on ape consciousness, mind and feelings through this new form of communication that had apparently been opened up. This new information could then lead to new thoughts on our moral attitude towards these apes and other animals in general. I have been active in the fields of animal consciousness and animal ethics, and one area of debate in

both is the way in which science can gather empirical data on the animals' inner being.[1] Comparative studies of the behaviour and nervous system of animal species can provide important information on the phenomenal consciousness of animals, that is, on their subjective experiential states. The term *phenomenal consciousness* was coined by the British philosopher of mind Ned Block (1993, 1995) and refers to the experiential properties of sensations, feelings and perceptions, thoughts, desires and emotions.[2] It is comparable to the notion of another British philosopher, Thomas Nagel, of *what it is like* to be a certain being (Nagel, 1979). Phenomenal consciousness thus concerns the ability of animals to experience both positive and negative internal states, such as pleasure, pain, joy, fear, hunger, and many others. However, this debate too has been quite controversial, and today representatives of different positions still argue strongly with each other. The existence of the ape language experiments and the reports coming from them, appeared to promise a different angle of approach and a new avenue of information on the subject of animal consciousness. Stories were published in which the apes used signs such as HURT, FUNNY and CRY to communicate how they felt. The chimpanzees signed HURT to indicate that they were in pain. They placed the sign on the head after a fall or on the belly when they had stomach ache. Washoe once signed FUNNY when she had a potty accident while riding on a human's back. Sometimes the apes signed CRY when they appeared to feel sad or frustrated. Systematic study of such communications might inform us about the particular things these animals liked and disliked, and give us a better insight into their subjective experiences and mental life in general. Their use of explicit, "human" terms to describe their feelings and thoughts might thus provide for additional knowledge that could have considerable relevance for scientific and moral questions.[3]

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[1] See my publications, some of them written together with my brother Titus: Dol, Kasanmoentalib, Lijmbach, Rivas & Van den Bos (1997); Rivas (1997); Rivas & Rivas (1991, 1993); Stafleu, Rivas, Rivas, Vorstenbosch, Heeger & Beynen (1992).

[2] Note the difference with other definitions of consciousness that refer to the cognitive, reflective or representational aspects of mental states (called *access consciousness* by Block).

[3] The nestor of the field of animal consciousness, Donald Griffin (1976, 1978), saw the signing of apes as an important new avenue to learn more about animal mind. He considered the signing of apes as evidence that they

Being thus highly intrigued by the potential of these experiments I focused much of my attention on examining the literature of the sign language research with apes. Several reports existed which contained information on chimpanzees' thoughts and feelings expressed in sign communications. However, I was also aware of several nontrivial arguments that could undermine these claims and published examples. In order to discuss these here, it is important to introduce the major protagonists of the ape language controversy. There were two different teams of researchers and writers on the subject, with considerably contrasting conclusions and opinions on ape signing. One team was centered around the two psychologists' couples the Gardners and the Fouts. In 1966 Beatrice and Allen Gardner of the University of Nevada at Reno started the first ape signing project with Washoe. Later they set up a second project with four other chimpanzees. Roger and Debbi Fouts subsequently took care of Washoe and the other chimpanzees and are still studying them today at Central Washington University in Washington State. The results of the research by the Gardners and Fouts led to the following conclusions on the signing behaviour of their chimpanzee subjects. The chimpanzees had acquired vocabularies of more than a hundred signs. They generally used the signs appropriately and spontaneously. The chimpanzees made combinations of signs which contained a clear semantic and grammatical structure, similar to that of human children's early combinations of words. They also creatively constructed novel combinations of signs to describe objects for which they did not have a sign. For example, Washoe called a swan a WATER BIRD. The chimpanzees used their signs to request things they desired from the humans, but also to make statements and comments, to ask questions, to communicate among themselves, and to explicitly express their feelings and thoughts. Based on the many similarities with children's early language the Gardners and Fouts used the term language to describe the signing behaviour of their chimpanzees.

"have mental experiences and communicate with conscious intent" (1976, p. 103). In a book on the ape language controversy Desmond (1979) also spoke about ape signing as a "new exploratory corridor to that

The other team in the ape language controversy consisted of Herbert Terrace and his colleagues at Columbia University in New York City. Terrace organized his own project with a chimpanzee he called Nim Chimpsky. He came to considerably opposite conclusions on ape signing from those of the Gardners and Fouts. Nim's sign utterances showed no semantic or grammatical structure, but consisted instead of uninformative and repetitious strings of signs. Nim generally had what Terrace called an "acquisitive" motivation when using his signs, that is, he used signs to acquire desirable objects, actions, or changes in the situation. He appeared to have certain strategies such as using wild card signs (very frequent signs that could always be appropriate, such as GIMME and his name sign NIM), which were focused on getting the humans to supply him with the things that he wanted. He also appeared to imitate the humans' signs to a large extent, something which was only discovered after extensive analyses of videotaped interactions. Terrace thought these same characteristics to be present to some extent in the signing of the chimpanzees in the other projects, which would then argue against the conclusions of the Gardners and Fouts. To the Terrace team then, there were many differences between chimpanzee sign use and human language, or indeed human children's early language.

Besides debate on these different results and conclusions, much heated discussion also took place on the methodologies used in the different projects. The unexpected results on Nim's signing behaviour provided by the videotape analyses made some critics wary of any sign observations that had not been captured on a permanent record such as film or video. There was also discussion on the value of incidental occurrences or anecdotes of sign use. Comparing these with systematic analyses of large corpora of sign utterances sometimes showed surprising and contrasting results. Disagreement also existed on a possibly intrinsic motivation that chimpanzees might have to use signs, because the apes were regularly subjected to drill sessions and were made clear that the humans wanted them to produce signs. This nature of the design of the sign projects could have led to meaningless routines

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boundless inner space we call 'mind'" (p. 19).

and the chimpanzees signing only to please the humans. Many other points of discussion existed and the debate continues up to this day.

This literature study of the language experiments with signing chimpanzees made me feel quite incapable of drawing final conclusions on the subject without having seen and studied the signing chimpanzees myself. At the end of my psychology study I had the opportunity to visit and work with Washoe and the four other chimpanzees at the Fouts' Chimpanzee and Human Communication Institute (CHCI) in Ellensburg, Washington. In this three month stay I was personal witness to the chimpanzees using their signs and I felt absolutely thrilled whenever they would come up to me and sign something. I studied the research that had recently been carried out at the CHCI and had good discussions with the Fouts and their staff. I was also struck by the love and affection with which the humans in the CHCI related to the chimpanzees. The chimpanzees were not treated as laboratory animals but as wonderful individuals that deserve respect and loving attention. Moreover, I was impressed with the moral viewpoints of the Fouts with regards to animal research. They were actively involved in the improvement of the fate of chimpanzees in general and argued against keeping them in captivity. Indeed, they regretted the fact that Washoe and the other chimpanzees were now living behind bars. The visit inspired me to set up a Ph.D. project proposal to further study the signing chimpanzees. Its research question was to find out in what ways the signing behaviour of chimpanzees can provide new information on the consciousness or subjective experiences of these apes. This proposal was accepted by professor Ton Derksen, head of the Philosophy of Science section of the Philosophical Department of Nijmegen University. Preparation took place to set up a new study on the chimpanzees' current or recent sign use. This was done in close contact and with valuable support from the Fouts and their dedicated staff members, students, and volunteers. Other scientists were also of considerable help in the construction of the study, of which especially

Lyn Miles of the University of Tennessee at Chattanooga should be mentioned, head of the project with the signing orangutan Chantek.

The study that was eventually carried out involved the systematic analysis of four large videotaped corpora of recent signing by the five CHCI chimpanzees. These corpora dated from the period between 1992 and 1999. Of the amount filmed in the four corpora, 22 hours of interactions between the chimpanzees and long term human companions were examined. This resulted in a number of 3,448 individual signed utterances that could be used for analysis. The following aspects of the chimpanzees' signing behaviour were analyzed:

- The individual signs that were used, the possible semantic category that a sign belonged to, and the sign's frequency.
- The combinations of signs that were made, the possible semantic structure of these (especially semantic relations), grammatical characteristics (sign order rules in particular), and the nature of multiple-sign combinations.
- The amount of imitation and other discourse phenomena.
- The communicative intentions underlying the chimpanzee utterances. To what extent were the chimpanzees requesting objects and actions, naming objects and pictures, describing properties and locations, reporting their internal states and feelings, or expressing other intentions?

This research was thus a descriptive behavioural study that looked at the production rather than the comprehension of signs. This dissertation describes the whole study in detail.

The results of the study were the following. In the four recent corpora the five chimpanzees used a limited part of their official vocabularies. They especially used object and action signs, as well as request markers and wild card signs. Combinations of signs showed no clear semantic or grammatical structure. Multiple-sign utterances did not communicate additional information and contained repetition and redundant signs. Imitation took place, but the large majority of signs were made spontaneously. There was a

predominance of requests for objects and actions in the communicative intentions underlying the utterances. In general, the recent signing of the five chimpanzees in the analyzed corpora showed close similarities with the way Nim Chimpsky had used his signs. Many aspects of sign use that the Gardners and Fouts had reported did not show up in this study's results. The signing behaviour of these chimpanzees in the recent corpora can therefore not be characterized as language. In this dissertation I will spend some time discussing how to explain these findings. The study of course only examined corpora of recent sign use. The chimpanzees' earlier signing may therefore well have been of the nature that the Gardners and Fouts described in their many publications. I conclude that new studies should regularly take place in which large corpora of current sign use are gathered and analyzed along the same lines as in this study. Also, analysis and publication of older (filmed) corpora would be a valuable source of information with which to further interpret the chimpanzees' earlier sign use.

Some clarification needs to be given here about the definition of language that I used in assessing the results of this study. In science and philosophy various definitions of language are used and not all disciplines agree on one common definition. Language exists of many different characteristics. One of these is the presence of words or signs that function like symbols. Another characteristic concerns the combinatorial properties of words and signs. Words and signs are combined in sentences that show a semantic and syntactic structure. These meaningful combinations enable language users to express more information than when words and signs are used separately. There are still other characteristics, such as the functions for which language is used.

There is some evidence that chimpanzees are able to acquire signs or lexigrams that function as symbols (see part II of chapter 5). Other animals appear to understand certain words, for example, dogs can comprehend that *out* means that they'll be taken for a walk. A good friend of mine has a crossbred Cocker Spaniel called Amy, whose curiosity to inspect

the house can be aroused by saying the word *mouse!* to her. There are also several animal species that have various alarm calls that refer to different types of predators. For example, vervet monkeys have different alarm calls for predator birds, snakes and leopards (Cheney & Seyfarth, 1990). Usually, however, these communications consist of single calls, words, signs, or lexigrams. When we look at the kind of language that human beings have, a definition of language in terms of individual symbols would not suffice. Soon after they start developing language, humans combine words and signs into meaningful sentences by which they can express a whole range of concepts, ideas, thoughts, emotions, and even fantasy. Though humans may share a symbolic ability with other animals, these properties of the combination of words and signs are what makes human language unique. Of course, the question in the field of ape language is whether other apes are capable of acquiring such a human language. In this dissertation the results on the projects with signing apes will be assessed with regards to the many different aspects of language. In the discussion of the results of my study I will compare the recent sign use of the chimpanzees in the four corpora with these different aspects of language. However, the definition that I will use to determine whether the signing of the chimpanzees in the recent corpora can eventually be called *language* mainly concerns the presence of the combinatorial properties of signs in sentences. I use this particular definition because a definition that only refers to the capacity for symbolic communication would lead to confusion. Readers might then think that because language has been ascribed to these animals, they also show the other characteristics of language, such as the meaningful combination of words and signs.

A note should be made here in order to take away a possible confusion about my intentions in writing this dissertation. Though my conclusions are negative with regards to the linguistic character of the signing behaviour of these five chimpanzees in the analyzed recent corpora, I in no way intend to degrade chimpanzees or conclude that they are dumb and uninteresting creatures. Our investigation of chimpanzee behaviour, cognition and

emotions has shown that they are highly intelligent animals who have much in common with humans. Also, though the chimpanzees may not demonstrate the combinatorial properties of language in their utterances in these recent corpora, they may well have grasped the symbolic nature of the individual signs. Chimpanzees continue to be highly fascinating animals and future research will still provide for many interesting discoveries on their behaviour. If my conclusions sometimes sound negative, this is only because the results of my study preclude a linguistic characterization of their signing behaviour, and not because I want to express a negative attitude towards the capacities of chimpanzees in general.

Contents of the dissertation.

This dissertation is made up of the following chapters. In *Chapter 1: Sign language research with chimpanzees* a comprehensive introduction will be given of the different projects with signing chimpanzees. The Gardners, Fouts and Terrace will be introduced and Project Washoe, Project Nim and the research with still further chimpanzees will be described summarily. Research methods with which the signs were taught will be mentioned, as well as the ways in which data were collected.

Chapter 2: The results of the projects with signing chimpanzees will then provide an extensive presentation of the results of these different projects. It contains a description of the findings of the research by both Gardners and Fouts, as well as by Terrace. The results will be presented according to the major aspects of the signing behaviour. Section 2.1. will focus on individual signs. It will present the acquisition criteria for the signs. The different semantic categories into which the different signs were divided will be examined, and the procedures mentioned by which signs were assigned to these semantic categories. The published information on the frequency with which the individual signs were used will also be summarized. Section 2.2. will deal with the combinations of signs that the chimpanzees

produced. The subject of semantic relations in these sequences will be examined. Creative combinations will be presented. The grammatical structure of sign combinations, in the form of reported rules for sign order and particular sign inflections, will then be discussed. Lastly, the nature of multiple-sign combinations will be analyzed. In section 2.3. the results concerning discourse phenomena and conversational skills will be presented. Among these are the amount of imitation by the chimpanzee of human signs and the degree of spontaneous sign communications. Section 2.4. will be dedicated to the communicative intentions underlying the chimpanzees' signed utterances. After a few words of introduction on the concept and study of communicative intentions, the various intentions reported by the different investigators will be presented. Chapter 2 will then conclude with section 2.5. in which the opinion of the different researchers and other scholars will be given on the question whether the signing of the chimpanzees is comparable to the early language of human children and may therefore be called language.

In the following chapter, *Chapter 3: Problems of method and interpretation*, several major problems will be presented that are important to keep in mind in the review of the reports on the chimpanzees' signing behaviour. In 3.1. the problem of using anecdotes and individual observations will be discussed. Their use can lead to a misrepresentation of the true nature of the signing and therefore to unreliable conclusions. Section 3.2. stresses the importance of systematic analysis of large unedited corpora of sign utterances. Analyses based on corpora have not always been a standard procedure in the projects. Corpora can give a representative picture of the chimpanzees' general signing and prevent unwarranted conclusions based on incidental examples that appear to show meaningful use of the signs. In the following section, 3.3., the nature of the human-chimpanzee relationship and interaction is taken into consideration. It mentions the presence of drill and human prompting in the projects. The chimpanzees were subjected to many questions that they had to respond to with signs. Sometimes they received rewards to ensure their cooperation. These procedures may

have stimulated a more extrinsic motivation on the part of the chimpanzees. In the last section, 3.4., several remaining problems of method and interpretation are discussed that have implications for some of the published reports on chimpanzee signing.

Chapter 4: A study of the recent sign use of five signing chimpanzees will then present the new study that the author carried out at the CHCI in order to obtain reliable and systematic information on the chimpanzees' recent use of signs. Taking the problems mentioned in *Chapter 3* into account, four large corpora of recent sign use in videotaped human-chimpanzee interactions are systematically analyzed. After an introduction in 4.1., the methodology of the study is given in 4.2. The results of the study are then presented in 4.3.

Discussion of these results takes place in *Chapter 5: Discussion.* The major patterns and phenomena of the chimpanzees' signing behaviour in the recent corpora are listed and discussed. Interpretations are made with which to explain this recent sign use by the five chimpanzees at the CHCI. Several issues from earlier chapters are referred to. This chapter also includes a discussion of the question whether the signs function as true referential symbols or whether their use can be explained by stimulus-response associations. A summary is also presented of the research on the use of lexigrams by the bonobo Kanzi in order to make a comparison with the signing chimpanzees. Lastly, suggestions for future research are made.

In an *Epilogue* I will close off the dissertation by making several personal and moral remarks that the results of this study bring me to. This will include information on certain aspects of the chimpanzee sign projects that are of moral relevance.

Esteban Rivas Amsterdam, March 2003

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Then I would like to thank Roger and Debbi Fouts for their hospitality and openness in welcoming me to visit the Chimpanzee and Human Communication Institute (CHCI) at Central Washington University in Ellensburg, Washington, and in inviting me to carry out research with the signing chimpanzees Washoe, Tatu, Moja, Dar, and Loulis. Their acceptance of me as a fellow researcher has opened up doors that normally stay closed for other scholars. I cannot thank them enough for giving me this unique opportunity. During my first visit in 1993, and the subsequent visits in 1995, 1997, and 1999, they have allowed and encouraged me to set up and carry out interesting research on the signing behaviour of the chimpanzees. Our cooperation has been the crucial factor in realizing this study. I am also

grateful for their permission to assist in the daily chores of taking care of the chimpanzees and giving me the possibility to interact, communicate, and play with these wonderful beings. I would also like to praise here their moral attitude towards animals. It was because of their moral positions that I, as an abolitionist of animal experimentation, decided to study chimpanzees who unfortunately had to be kept in captivity. Indeed, the moral atmosphere at the CHCI has been special and unique, and I have never before nor ever since encountered a similar group of people who are so dedicated to their animals and who put the chimpanzees' interests first at all times. I also thank the Fouts' staff of people, among whom Mary Lee Jensvold, for their input and advice at many points along the course of this study. Furthermore, I thank Vicki Kennerud, Mark Bodamer and Mary Lee Jensvold for allowing me to examine their research material.

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CHAPTER 1 SIGN LANGUAGE RESEARCH WITH CHIMPANZEES

Introduction to the projects and their history.

Through the ages scientists and philosophers have wondered whether nonhuman animals are capable of language. For thousands of years people have told fairy tales and fables in which all kinds of animals are capable of speaking, and talk, wisely and unwisely, with each other and with humans. In these stories animals are expressing their thoughts and feelings by means of language. When the different species of nonhuman great apes, the chimpanzees, bonobos, gorillas, and orangutans, were discovered by western humans, these closest relatives of the human species became the subjects of study and research. Scientists investigated their physical characteristics as well as their behavioural and mental abilities. These abilities were then compared with those of human beings in order to find out the degree of similarity between the ape species. Discovering many similarities between the human and the nonhuman great apes fueled the curiosity of scientists to explore whether these apes might also be capable of language.

Spoken language experiments with nonhuman great apes.

In the 20th century several attempts to teach great apes a spoken language were set up. Most of these took place within experiments in which apes were raised by humans in their own home. These home-raising projects had been set up to study the effects of such an upbringing on the behaviour of the apes. The majority of these investigations were carried out in the United States of America. As a part of these projects scientists investigated whether an ape was actually able to utter human vowels, consonants, and words.

Witmer and the chimpanzee Peter. The first attempt was a project with a chimpanzee who had been given the name of Peter. He was about 5 years old and had been trained to perform for an entertainment theatre in Philadelphia in the beginning of the century. The psychologist Lightner Witmer (considered the "father of clinical psychology") studied his cognitive abilities in the year 1909 and tried to make him articulate the English word *mama* and the letter *p*. Witmer reported that *mama* was learned with "considerable effort" and "apparent unwillingness," and eventually only sounded like a "hoarse whisper" (Fouts & Rigby, 1977; Kellogg, 1980). Despite this limited success Witmer predicted future, more successful language experiments with apes.

Furness and orangutan. The next scientist to make an attempt was W. H. Furness. He raised a young female orangutan in his home and trained her to produce the words *papa*, *cup* and the sound *th* over a period of 11 months (Fouts & Rigby, 1977; Kellogg, 1980; Ristau & Robbins, 1982). He did so by manipulating the orangutan's lips with his fingers, opening and closing them in the proper rhythm (Kellogg, 1980). Furness published about this experiment in 1916. Like Witmer, he found that the ape could utter the words only with great difficulty and in a hoarse voice.

The Kelloggs and the chimpanzee Gua. In the 1930s Winthrop and Louise Kellogg home-raised an infant chimpanzee. The Kelloggs, who were connected to the University of Indiana, acquired a 7.5-month-old chimpanzee from a laboratory in Florida, the Yerkes Experimental Station in Orange Park.[4] She was called Gua. For 9 months the Kelloggs raised her in their own family, which included their son Donald, who was of about the same age as Gua. Both infants were treated in the same manner by the Kelloggs. Thus Gua was raised as if she was their child. This method has since been called *cross-fostering*: the raising of an individual by foster parents of another species, by bringing it up as if the individual is a child of the foster parents' own species (Gardner & Gardner, 1985, 1989a; Kellogg, 1980). The practice of cross-fostering chimpanzees with humans as their foster parents is a scientific

enterprise to study its effects on the development of behaviour and intelligence in the chimpanzee subjects, also called cross-fosterlings. Its main research questions are in what way other animals absorb the environmental influences from their upbringing in a human family and to what extent their genetic make-up limits their acquisition of human(like) skills (Kellogg, 1980).

By manipulating her lips, the Kelloggs tried to teach Gua taught to produce the word *papa*. This was without success: Gua made movements with her lips, but she did not produce a sound (Fouts & Rigby, 1977; Ristau & Robbins, 1982).

The Hayes and the chimpanzee Viki. Keith and Catherine Hayes were another couple who home-raised and cross-fostered a chimpanzee. They were slightly more successful in getting their cross-fosterling to produce human sounds. In 1947 they obtained the female chimpanzee Viki from the Yerkes Laboratories of Primate Biology in Florida (where the Hayes both worked). She arrived a few days after she was born. The Hayes then raised her in their home as if she was their child. They taught Viki several words by manipulating her mouth and lips and rewarding her for sounds that approximated their goals. After 6 years in the Hayes' home, Viki could produce four words: *mama*, *papa*, *cup*, and *up*. However, they found that, like Witmer's and Furness' subject, the chimpanzee had quite some difficulty producing the words and the sounds had a hoarse character. Though having been called "the acme of chimpanzee vocal achievement in the production of human speech sounds" (Kellogg, 1980), still, Viki's words were often inaudible, and, more important, often used incorrectly (Fouts & Rigby, 1977; Hayes, 1951).

Laidler and orangutan. A last experiment teaching spoken language was carried out by K. Laidler, who published his results in 1978. Using operant conditioning he trained an infant male orangutan over the course of 9 months to produce four sounds: *kuh, puh, fuh*, and *thuh*. He was taught to produce them for "milk and other beverages in a mug (*kuh*), contact-

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[4] The pioneering primatologist Robert Yerkes provided them with this chimpanzee.

comfort (*puh*), pan and solid food (*fuh*), and brushing continuation (*thuh*)" (Ristau & Robbins, 1982, p. 143).

Anatomical differences between humans and other apes have been suggested as the reason for the failure of these experiments to teach nonhuman great apes a spoken language. The linguist Philip Lieberman (1984, 1991) performed several experiments on the vocal apparatus of the different apes. He concluded that these demonstrated the nonhuman apes' inability to use their vocal tract in order to produce and articulate words. Humans, in contrast, are able to speak because they have an L-shaped vocal tract, the oral cavity is at right angles to the pharynx and the place of the larynx is relatively low in the neck (Carstairs-McCarthy, 2001). Neuroanatomical findings also play a part in the explanations of the apes' inability to speak. The dominance of the limbic system in their vocalization appears to preclude a volitional control over their vocalizations. Eric Lenneberg has suggested that the central nervous system of nonhuman great apes provides important constraints on their vocal language capability (Wallman, 1992). Further theories have been constructed by which to explain this difference between humans and other apes. Whatever the theory, after the spoken language experiments with apes, language was thought to be an ultimate species-specific capacity of humans, confirming the idea of the uniqueness of human language held by many thinkers and scholars in the past centuries and millennia.

A signed language instead.

Spoken language may be the most widely used mode of language of current-day humans. It is, however, not the only form of human language that exists. Another major form of language uses the visual-manual or visual-gestural rather than the auditory-vocal mode: sign language. There are various sign languages across the world: American Sign Language, Dutch Sign Language, British Sign Language, Chinese Sign Language, and many others.

Though in the projects above the apes were taught the spoken form of language, the idea of teaching apes a sign language instead had not been alien to the mind of scientific scholars and thinkers. Already in 1661 Samuel Pepys (then treasurer of the British fleet), upon seeing a chimpanzee for the first time, wrote in his diary that "I do believe it already understands much English; and I am of the mind it might be taught to speak or make signs" (cited in Hewes, 1973). In his famous 1748 book *L'Homme Machine*, the French physician and Enlightenment philosopher Julien Offray de La Mettrie proposed teaching sign language to apes in a school for the deaf. Using the term monkeys also to refer to apes, he wrote:

> Why should the education of monkeys be impossible? Why might not the monkey, by dint of great pains, at last imitate after the manner of deaf mutes, the motions necessary for pronunciation? ...it would surprise me if speech were absolutely impossible in the ape. (cited in Fouts & Rigby, 1977)

Pepys and De La Mettrie were not the only ones to make such conjectures. According to Wokler (1995) much speculation about teaching a sign language to apes was taking place in the scientific circles of the 17th and 18th century, including in the schools where sign languages were set up for the deaf.

In the 20th century Robert Yerkes, one of the great American pioneers of primatology, suggested in his 1925 book *Almost Human* that nonhuman great apes could be taught a sign language:

> I am inclined to conclude from the various evidences that the great apes have plenty to talk about, but no gift for the use of sounds to represent individual, as contrasted to racial, feelings or ideas. Perhaps they can be taught to use their fingers, somewhat as does the deaf and dumb person, and helped to acquire a simple, nonvocal "sign language." (cited in Fouts & Rigby, 1977)

The Russian psychologist Lev Vygotsky also suggested teaching a chimpanzee the sign language of the deaf, in a work he wrote in 1929-30 (Ivanov, 1976). The Hayes themselves

had already thought of the possibility to teach Viki a signed language, but did not attempt this because they had other research questions in mind.[5] Viki did learn a few basic communicative gestures, though.

I. The Gardners.

In the 1960s another psychologists couple, R. Allen and Beatrice T. Gardner[6] from the University of Nevada at Reno, struck at the idea of teaching a form of sign language to a chimpanzee.[7] History was to prove that this idea was a genious one. The Gardners had come upon it by close study of what was known about chimpanzees at the time. They were thus aware of the chimpanzees' manual dexterity in that these apes can do "almost anything with their hands," (Gardner & Gardner, 1971, p. 120). They also knew that chimpanzees have naturally occurring communicative gestures, such as an open hand gesture with which they beg for foods and other services amongst themselves. Furthermore, the Hayes had been successful in teaching their cross-fostered Viki several communicative gestures. The Gardners then were the first to actually set out a whole project in which a chimpanzee was taught hand signs instead of spoken words. They started off their "pioneering effort"[8] with the chimpanzee Washoe.

Project Washoe 1966 – 1970.

The Gardners started Project Washoe on June 21, 1966. It was on that day that a young female chimpanzee arrived at their house. They named her Washoe. She was kept in a used house trailer in the backyard of the Gardners' home in the suburbs of Reno. Project Washoe

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[5] The linguist Gordon Hewes (1973) corresponded in 1951 with the Hayes about trying out an experiment in teaching Viki a sign language.

[6] Allen Gardner was an experimental psychologist who had worked with rats. Beatrice, or Trixie, Gardner was a psychologist and ethologist who had studied under the Nobel prize winner ethologist Niko Tinbergen in Oxford, where she obtained her Ph.D.. She had worked on the hunting behaviour of the jumping spider (Fouts, 1997; Linden, 1981).

[7] Hewes (1973) explains that they came upon this idea "entirely independent of conception," despite the references of earlier scholars on the subject.

[8] Ristau & Robbins (1982).

was to last until September 30, 1970, covering a period of 51 months, or four years and three months (Gardner & Gardner, 1972).

Washoe was estimated to be between 8 and 14 months old when she arrived at the Gardners' home. Up till that time she had been living in the wild in Africa, where she was captured and then sold to the Gardners by "a trader" in the US (1971). Fouts (1997) specifies that Washoe had come from Holloman Aeromedical Laboratory in New Mexico, where she was part of the United States space program. Washoe had been called Kathy before the Gardners changed it to Washoe. She arrived at Holloman in the Spring of 1966.[9] Before they could enter her into medical experimentation, the Gardners visited the Air Force laboratory. They chose Kathy, being the largest and healthiest infant, as their chimpanzee to be cross-fostered. Thinking that a chimpanzee should not have such a human name as Kathy, they renamed her after the county where the Gardners' house (and therefore the chimpanzee's new home) and university were located: Washoe county in Nevada (Fouts, 1997).[10]

Cross-fostering.

The Gardners wanted to raise a chimpanzee infant to see in what way and to what extent an individual of this primate species would acquire the skills and culture of humans. For this purpose they used the method of cross-fostering. This did not only mean raising a chimpanzee and bringing it into adulthood.[11] The method meant raising Washoe *as if she was a human child*, that is, as closely as possible to the way a normal human child would grow up in a normal human household. The Kelloggs, who pioneered in raising great apes by cross-fostering, explain the method by drawing attention to the fact that not only the physical features of the ape's cross-fostering environment should be of a human nature, but also the

[9] In the laboratory she was known as chimpanzee # 474 (Fouts, 1997).
[10] In its turn, the county name refers to the Washoe tribe of Native Americans that used to populate this area of Nevada before the arrival of Europeans. The word Washoe in their language stands for "people." The Washoe have been living around Lake Tahoe for over 9,000 years. Today there are about 1,500 tribal members of the Washoe people (http://itcn.org/tribes/washoe/intro.html).
[11] Though it had been the original intention to keep Washoe in a cross-fostering environment until adulthood, the Gardners ended the project when she was about five years and one month old.

psychological aspects: the humans should relate to the ape in the same way they would behave toward a human child (Gardner & Gardner, 1989a; Fouts, 1997).

The rationale for the cross-fostering method was that almost all behaviour of animals, including that of humans, was subject to change depending on experience and environmental influence early in life. The Gardners, who were behaviourists, word it as follows: "It seems as if no form of behavior is so fundamental or so distinctively species-specific that it is not deeply sensitive to the effects of early experience" (1989a, p. 4). As examples of this early experience they mention the imprinting mechanism in birds and other animals. They refer to the studies on gulls by Niko Tinbergen. He had herring gulls cross-foster lesser black-backed gulls and vice versa. He found that the cross-fostered young, the cross-fosterlings, took over the migratory behaviour of the species they were raised by. This happened even when this was contrary to the supposed species-specific behaviour of their own species. Raising Washoe as closely to the raising of a human child as possible would therefore model the influences that human children are subject to when they are born into a human family and environment. This would then ensure the best possible success of the cross-fostering method with Washoe.[12]

Washoe's housing conditions consisted of a house trailer of 8 x 24 feet (or 18 m^2).[13] It had three rooms and was similar to a human dwelling of the time. It had a bathroom with a sink, a bathtub and toilet. Then it had a kitchen with sink, a stove and a refrigerator. Finally there was a bedroom with a bed with sheets and blankets. The rooms contained furniture such as tables, benches and storage cabinets. The cabinets contained clothes, blankets, combs,

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[12] Project Washoe was not focused specifically or exclusively on language, but on the amount of human culture that could be bestowed upon chimpanzees by the practice of cross-fostering. The Gardners were interested in what way the environment made a difference in what was particularly human and what chimpanzee behaviour. In their endeavour to create a similar environment to a human upbringing, language also had to be part of the conditions, because children grow up while learning a language. It is then that they think of a gestural language. Obviously, their focus centered on the signing behaviour, but the Gardners and their team have also looked at motor development and the emergence of the developmental stages of object permanence of their cross-fostered chimpanzee subjects (1994b).

[13] The information on the housing conditions and other aspects of Washoe's life as a cross-fosterling was taken from the following sources: Fouts, 1975a, 1983a, 1997; Gardner & Gardner, 1971, 1974a, 1978, 1980, 1985, 1989a, 1989c, 1994b; Van Cantfort & Rimpau, 1982.

brushes, lotions, books, playthings, housekeeping utensils and tools. The trailer stood in a fenced yard of an approximated 5000 square feet (465 m^2). In this yard with trees, shrubs, and flowers Washoe was allowed to play and roam around. There were also playthings, such as a jungle gym and a tire swing that hung from a weeping willow tree. Washoe was also allowed to play in the garage of the house, which the Gardners painted with jungle scenes on the walls. In the garage was a mattress for Washoe to bounce on and various other objects.

Washoe was given objects children get when they are young such as toys. Dolls appeared to be Washoe's favourites. She was provided with picturebooks and magazines, and the Gardners and their colleagues would name and explain to Washoe the pictures and even tell stories about them. Her human companions would also groom her and she would groom them. She was played games with, such as chase, hide-and-seek and blind person's bluff. She also was given piggyback rides. Washoe rode in a tricycle and was taken for wagon rides by the humans. She also played in the sand box. Another favorite game of Washoe was "Simon Says." In this children's game one person has to imitate the other. Fouts (1997) describes that a human would sign DO THIS and then did something, for example, covering the eyes with the hand. Washoe would imitate this, after which another behaviour was the goal. Washoe also learned to sew[14] and she liked to draw on paper with a pencil. She also appeared to be fascinated by household tools. The Gardners mention that she acquired "a creditable level of skill with hammers and screwdrivers" (1985, p. 159). In general, she was involved in activities in the same way that human children are.

Like a human child, she was also submitted to discipline and cleaning activities, such as brushing her teeth, learning to drink from a cup and to eat with forks and spoons while sitting in a high chair with a bib around her neck. She was dressed in clothes (early in the project she also wore diapers) and learned to dress and undress herself. She was taught to set and clear the table, and even to wash the dishes (though the Gardners (1985) say she did this

[14] Fouts (1997) mentions that while sewing "Washoe did not actually mend anything, she would go about her random stitching with complete concentration for twenty or thirty minutes at a time" (p. 34).

in a childish way). She also was toilet trained.[15] She was scolded and punished when misbehaving or doing something wrong.

Washoe was also taken on outings away from the Gardners' home. They would visit the home of one of Washoe's human companions, go to a pond, a meadow or to the woods, as well as various buildings of the university, such as its nursery school (when the children were not there). Special visits with a car would also be made to get some snacks at ice cream places like Dairy Queen or fast-food restaurants such as McDonalds.[16]

All of these activities were done with the goal to provide a good cross-fostering environment. To model the language use of a human family, the human participants in Project Washoe signed about everything that happened, about the activities they did and the objects that were present. They also signed among themselves when Washoe was with them. In fact, it was not allowed to use speech in Washoe's presence, in order not to confuse her and provide the best conditions for her acquisition of signs.

American Sign Language.

The Gardners chose to teach Washoe the sign language of the deaf and hard of hearing in the United States: the American Sign Language. It is abbreviated as ASL and sometimes shortened to Ameslan. The Gardners decided in favour of a language that had already been developed and that was in wide use. Creating a new, synthetic language of gestures would have been a formidable task with many possible problems. Also, using an already existing language ensured that they were indeed teaching the chimpanzee a language rather than something else. Furthermore, choosing ASL had another excellent advantage in that it gave them materials with which to compare the achievements of Washoe. They could use the

[15] The Gardners (1985) mention that she became so accustomed to using a toilet that she "seemed embarrassed when she could not find a toilet on an outing in the woods, eventually using a discarded coffee pot that she found on a hike" (p. 159).

[16] They would only go to these places if there was a secluded parking lot in the back. Washoe would then stay in the car with a human companion, while another human went to get the treats. This precaution was taken to avoid curious people seeing Washoe and coming up to speak to her. Such exposure to spoken language would then go against the sign-language-only policy (described in the next paragraph) of Project Washoe.

linguistic development of children learning ASL and the results of scientific studies on ASL acquisition as comparison material with which to assess the degree of similarity of Washoe's acquisition of signs.

Because American Sign Language is thus an important reference point of the ape sign projects and the chimpanzees were taught signs that were based on ASL signs, it is necessary to supply some summary information on the nature of this language. For thousands of years deaf and hard of hearing humans have developed and used sign languages in many parts of the world (Bonvillian, 1999; Sandler & Lillo-Martin, 2001). Socrates mentions the sign language of the deaf in Greece (Hoffmeister, 1978). Native Americans (the Great Plains Indians) had a sign language, though this was used more for intertribal communication by hearing individuals than that it was a language especially for deaf individuals. In the eighteenth century in Paris the French clergyman Abbé Charles Michel de l'Épée standardized the signs used by deaf humans and invented new ones based on French spoken language, what he called his *signes methodiques* (Stokoe, 1960; Lane, 1980; Woodward, 1978). In doing so he laid the foundation of modern sign languages. During a visit to Europe, the American minister Thomas Hopkins Gallaudet got inspired by the work of De l'Épée. Back in America Gallaudet set up the first school for the deaf in the USA in 1817.[17] Like De l'Épée, he standardized the signs. Together with signs of already existing sign languages in the United States, this was the basis for American Sign Language (Stokoe, 1960; Woodward, 1978). Because of the French connection ASL was strongly influenced by the French sign language (LSF), borrowing many signs from it (Stokoe, 1960; Terrace, 1979a).

Each sign of a sign language stands for a whole concept and thus carries a specific meaning. In ASL an English gloss (which is printed in capital letters by convention)[18] is

[17] In 1864 Gallaudet College was founded in Washington, D.C. Its first president was Thomas Hopkins' son, Edward Miner Gallaudet. Today it is called Gallaudet University.

[18] In the literature on signing apes, their signs are sometimes also printed in italics or between quote marks. In the later publications, though, the sign's gloss is printed in capitals, in common with human sign language research. In this dissertation the signs' glosses will be represented by capital letters. However, in quotes from the literature, the original use of italics, quote marks or capitals will be left unchanged.

given to a sign, which is an approximation of its meaning. Some signs are iconic, in that the referent is visually depicted in the sign. An example is the sign HUG. It is made by crossing the forearms and then contacting the chest or upper arms with the hands. Another is the sign CAT. It is made by contacting the cheek or mouth with the index and thumb of a pincer hand and then moving it out to the right, as if pulling at imaginary whiskers. However, in the large majority of signs the relationship with their referents is totally arbitrary. For example, the sign GREEN is made by shaking an index and thumb extended from a fist (G-hand) in front of the chest

The pioneering researcher on ASL, William Stokoe, has been of central importance for the recognition by scholars of sign language as a genuine natural language. In the 1960s he showed that ASL signs have a distinct structure. His own and others' later research demonstrated that ASL has a large lexicon and that it has its own phonology, morphology and syntax (Armstrong, Stokoe & Wilcox, 1995; Bonvillian, 1999; Klima & Bellugi, 1979; Sandler & Lillo-Martin, 2001; Stokoe, 1960; Stokoe, Casterline & Croneberg, 1965). Stokoe was the first to explain that ASL signs are made of three formational aspects or elements. These are: place, configuration and movement.[19] Each sign is made at a particular *place* or location on the body or in space. This can be some part of the face, body, in front of the signer, and so on. Then the sign is produced with a specific *configuration* or shape and orientation of the hand(s). This can be a fisted or an open hand, some fingers can be extended, and the hand and palm can have a specific orientation towards the place. Several names have been given to the different configurations that are possible. The curved hand has all fingers curved. In the claw hand the configuration of the fingers are as if they claw. Some signs contain a signed letter in the configuration. Thus there exists the A-fist, in which the fingers take the shape of the ASL letter A while the rest of the hand is in the shape of a fist.[20] The third formational aspect of a sign is the *movement* or action of the hand(s). This involves

[19] In current ASL research the three formational aspects are referred to as location, handshape, and movement.

the type of movement as well as the direction of this movement. It can consist of simple contact or rubbing, the movement can be made upward or downward, and it can be a straight or circular movement.[21] The Gardners based themselves on Stokoe's work in their interpretation of the chimpanzee signs. From 1989 onwards, they call the description of the three aspects for convenience sake PCM descriptions (Gardner, Gardner & Nichols, 1989).

The three formational aspects are comparable to the phonemes of spoken language. Phonemes are meaningless but distinctive features that together form morphemes, the smallest meaningful elements of words. For example, the words "mill," "kill" and "will" all have the same last three letters. The first letter is different and this phoneme causes an important change in meaning. In comparison, the three formational aspects are the smallest meaningless building blocks out of which signs are constructed. A change in one of these, causes a similar difference in meaning as we saw with phonemes. For example, the signs FLOWER, KISS and HOME are all made with a tapered hand and a side-to-side movement across the face, but their location is different (at the nose, at the lips then the cheek, and at the lower then upper cheek, respectively). Stokoe (1960) called the formational aspects *cheremes* as an analogue to phonemes.[22] The Gardners (Gardner et al., 1989) and Terrace (1979a) also made use of this term in their work, but it is not widely used in sign language research (Bonvillian, 1999).

American Sign Language and other national sign languages are true natural languages in that they contain all the linguistic characteristics of spoken language. They contain a semantic and grammatical structure. There are rules for sign order (Brown, 1973; Neidle, Kegl, MacLaughlin, Bahan & Lee, 2000; Sandler & Lillo-Martin, 2001; Wallman, 1992). The basic underlying hierarchical order of ASL is subject-verb-object or SVO (Neidle et al.,

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[20] Most sign languages also include a manual alphabet, where each letter of the written alphabet has a sign equivalent. With these signed letters, words and names of people and places can be fingerspelled.

[21] In most sign languages the signs are not made just anywhere. They are made in what is called the signing space. This is the space from the signer's waist up to its head and in front of these.

[22] Others, however, argue against the interpretation as cheremes. Healy (1980) is of the opinion that the PCMs are more closely analogous to the distinctive features of signs rather than to phonemes.

2000). Other grammatical aspects are expressed by ways of inflection and modulation of the signs. In these techniques the original citation form of the sign is changed which has consequences for the sign's meaning. The following are important inflectional devices. Reiteration or repetition of (a) sign(s) can indicate emphasis. Reduplication of a sign can indicate plural subject or object or the verb aspect (Wilbur, 1980). Direction is also an important syntactic inflectional device. One can indicate the subject and the object of a verb by making the sign towards the respective person. For example, one can make the sign GIVE by starting from one's own body towards an addressee, which would then mean "I give you," whereas the reverse would mean "You give me." Another inflection is making the sign with two hands to increase the emphasis or intensity of the meaning. In what has been called the "establishment of loci" the place of the sign is made on the person that is indicated to be the subject of the sign. Facial expressions and body postures are also part of the grammar of ASL. Non-manual grammatical markers such as raised brows, a backward head tilt, and a tensed upper lip can indicate relative clauses, for example (Sandler & Lillo-Martin, 2001; Wilbur, 1980).

For a long time, sign languages were not recognized as actual natural languages. In education, deaf humans were discouraged to learn a sign language and had to attempt to acquire an oral language (Bonvillian, 1999; Lane, 1980). Eventually, linguistic research demonstrated the linguistic nature of sign languages. Today ASL is the fourth most used language in the USA and it is also used in the English-speaking parts of Canada.

Like with spoken language, there is no universal sign language.[23] Sign languages are different from each other as spoken languages are different from each other. Like a hearing person does not understand a foreign spoken language a deaf person can not understand a foreign sign language. Also, there are regional differences or dialects within each sign language, in the same way that regional dialects exist in spoken languages. Like users of spoken language constantly change their words, users of sign languages are continuously

changing, adding and modifying the particular shapes and uses of the signs (Woodward, 1978).

Chimpanzee signs.

The Gardners (1980) based the gloss of the chimpanzee signs on the nearest word equivalent in English, which often was the official gloss for the ASL sign that was closest to the chimpanzee sign. Note, however, that not all the signs that were learned by the chimpanzees are actual signs from ASL. In most cases, the ASL sign was the model for the chimpanzee sign. However, the chimpanzee signs would sometimes differ from the ASL ones in form or in meaning.[24] An example of difference in form concerns the sign BOOK. In ASL this is produced by the palms of opposite hands contacting then turning to palms up. This sign is difficult to make for chimpanzees, since the palms of their hands are not easily put against one another. Therefore, the chimpanzee form of BOOK consisted of the palms grasping rather than touching each other fully. An example of difference in meaning is the chimpanzees' sign for BIB/NAPKIN. This not only referred to bibs and napkins, but also to washcloths, handkerchiefs, facial tissues, toilet paper and other such items. In ASL there are individual signs for all of these objects. Another example is the use of the ASL sign for STRAWBERRY as BERRY, that is, the chimpanzee sign referred to all small fruits, including strawberries, but also cherries and grapes (Gardner & Gardner, 1972).

In this dissertation, the signs that are mentioned throughout the text refer to the particular signs that the chimpanzees were taught and learned. They should therefore not be confused with ASL signs.

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[23] This is one of the myths about American Sign Language that Markowicz (1980) exposed.

[24] The Gardners sometimes referred to Washoe's signs as "Washoese" (1971, 1972). They say that "it is true that 'Washoese' is not precisely equivalent to ASL, but the correspondence is close, especially if 'Washoese' is compared with the 'baby talk' of very immature human beings" (1971, p. 128). Later (1978) they say that they "do not assert that our chimpanzee subjects use the signs of Ameslan... Instead, we can marshal a very large body of empirical evidence and independent linguistic analysis, all agreeing with the conclusion that the

Methodology.

The methodology of Project Washoe will now be described in some detail. The methods of teaching the signs and of collecting data on the chimpanzee's use of the signs are explained. The types of formal tests in assessing Washoe's sign use are also briefly presented.

It is important to note here that most of these methods have been used in all of the projects with signing chimpanzees: the Gardners' second project, the Fouts' continuation of studying the Gardners' chimpanzees, as well as their study on cultural transmission in Project Loulis, and Terrace's own study with the chimpanzee Nim Chimpsky. The Fouts will be introduced in Part II of this chapter. Terrace and his Project Nim will be presented in Part III.

Teaching methods.

The Gardners were behaviourists and this showed in the teaching methods that they used and their discussion about them. In their 1971 publication, under the heading "The S-R Paradigm", they stated that "The acquisition of individual signs is the aspect of this project that is most clearly related to the paradigm of S-R reinforcement theory. This paradigm ... had a strong influence on the tactics that we used for teaching individual signs" (p. 129). It "specifies two initial objectives for a training program. Conditions must be arranged to raise both the probability of particular cheremic responses in particular appropriate situations and the probability of cheremic responses in general." Applying the S-R paradigm meant that the Gardners used positive reinforcers to reward the behaviour they wanted to see in Washoe: "In training Washoe we never hesitated to apply those prescriptions of reward theory that were relevant" (p. 130). They admitted that it is "intuitively unreasonable" to assume that simple instrumental conditioning is the way by which children acquire language. However, they explained that "a minimal objective of this project was to teach Washoe as many signs as

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communicative gestures of our chimpanzees would be called signs if they were used by human children and that the chimpanzees use signs in a rudimentary, childish form of Ameslan" (p. 42).

possible by whatever procedures we could enlist," (1969, p. 668). Therefore they did not hesitate to use rewards. Tickling was found to be the most effective reward.

Shaping.

Shaping was used to teach Washoe some of her earliest signs. In shaping the humans rewarded movements or cheremic behaviour[25] by Washoe in appropriate situations so that this resulted in Washoe acquiring every time a little closer approximation of the sign that was to be learned. The sign MORE was acquired through shaping. It started by rewarding Washoe with tickling for a playful protective movement that she made by herself when she expected more tickling. In this movement Washoe brought her arms together to cover the place that was (going to be) tickled. Her human companions continued to reward her with tickling so that after a whole series of ever closer approximations, Washoe made the correct form and movement of the sign MORE (fingertips of opposite hands contact, which is close to the official ASL sign). Washoe then spontaneously transferred the use of MORE to other situations, where they could then reward her by giving her more of whatever she was asking for when she used the sign. OPEN was another sign acquired by shaping. First they rewarded Washoe's action of pounding on doors that she wanted to be opened. They did so by opening the doors, so that she could go to certain places that she found interesting but that were inaccessible because of the closed doors. They then shaped her pounding movement into the sign for OPEN: the index edges of opposite hands contact and then the hands separate while rotating. Washoe then spontaneously transferred the use of this sign to other situations, including for containers such as boxes and even when she wanted the water faucet turned on. They could then reward her by opening these containers or by turning the faucet on.

[25] In order to stay close to the descriptions of the Gardners the terms "cheremic behaviour" and "cheremic responses" are used in this text.

Such shaping was only used in the first year of Project Washoe, though. The Gardners found that moulding of the hands, or physical guidance (to be described shortly), was a much more efficient shaping method.

Babbling.

Before children speak their first word at about the age of one year, they start babbling from about the age of six or eight months. Babbling consists of spontaneous play with vocalizations (which sometimes approach phonemes). Deaf children similarly babble manually. They play with their hands and make sign-like gestures out of which signs can evolve (Bonvillian, 1999; Petitto, 2000). The Gardners interpreted this to occur in Washoe as well, in the early days of the project. She made spontaneous cheremic responses that were not associated with appropriate situations. They could shape these cheremic responses into signs by praising those behaviours. The sign FUNNY was, however, the only sign that was acquired by making use of babbling. Washoe liked to touch her nose and those of her human companions with her index finger. This behaviour is somewhat similar to the ASL sign for FUNNY, which is made by the tips of the index and second fingers rubbing down the nose. The Gardners encouraged Washoe's behaviour by creating a regular nose-touching game. The humans would behave as if this game was very funny. They accompanied the interaction with laughter and smiles. This game was also started when things happened that even Washoe might consider to be funny. Eventually Washoe spontaneously used FUNNY in "roughly appropriate situations" (1969, p. 667). They admit, though, that this was the weakest sign that she acquired (Gardner & Gardner, 1971).

Moulding.[26]

In this procedure, the humans took the hand(s) of the chimpanzee and moulded or formed them into the correct configuration, put them through the correct movement and directed the hands to the correct place of the sign they wanted to teach. This moulding was usually done in the appropriate context (though not always), which mostly consisted of the presence of an object for which the sign was its name, or during a particular action for which the sign was learned. The first sign that Washoe acquired through the use of moulding was TICKLE. It was the 6th sign within her vocabulary that she learned. The technique of moulding proved to be a very effective teaching method.

Modeling and imitation.

The Gardners and their assistants used the signs of ASL not only in their interactions with the chimpanzees, but also in the communications between the humans themselves, when the chimpanzees were present. Thus, the chimpanzees had frequent exposure to the signs and could learn signs through observational learning. The humans would also explicitly model signs. They would sign short sentences in which the referent of the sign was pointed out. The humans would draw attention to some object and then sign "This is an X", in which the X stood for the new sign to be learned. Similarly, for action signs they would tell Washoe (in signs) sentences such as "You are Xing".

They also tried to use imitation to teach her new signs. However, it was difficult to get Washoe to imitate on command, so rewarding her by tickling was necessary to get her to imitate. Whole new signs could not be learned in this way, but the Gardners could use imitation to increase the frequency and refine the form of certain signs. When Washoe made an incorrect sign in a situation, they would make the correct sign and repeated it until Washoe would make the sign herself. For signs that were less new they could prompt her by simple

[26] In some publications Fouts has called the moulding procedure (a form of) guidance (Fouts, 1972, 1975a, 1975b, 1997; Fouts & Budd, 1979).

pointing at, or touching, her hand or body part that was included in the PCM of the correct sign. They would further evoke Washoe's signing by telling her to SIGN, or ask questions such as WHAT DO YOU WANT? and WHAT IS IT?

> In general, the humans in the projects created an environment that was maximally stimulating and maximally associated with ASL. Washoe's human companions demonstrated the uses and extolled the virtues of the many props. Routine activities of the day - feeding, bathing, dressing - were performed in a ritualized fashion and appropriate signs figured prominently in the rituals. We invented games, introduced new objects, showed picture books and magazines, and made special scrapbooks of Washoe's favorite pictures, all to demonstrate the use of ASL. (Gardner & Gardner, 1971, p. 125)

Eventually then, several different methods were used in teaching Washoe signs. The Gardners called their teaching "a rough-and-ready mixture of training methods" (1969, p. 672). The same variety of simultaneous teaching methods was also to be used in the Gardners' second project and in other projects with signing apes.

Data collection methods.

The basic method of data collection that the Gardners used, consisted of the humans individually writing down their observations into what were called the field records. Notes on the context and the quality of the form of the signs were present within these records. The field records provided the criterial observations used in the definitions for an observed and a reliable sign (see section 2.1.1.).

When Washoe's vocabulary was still small, exhaustive records could be kept of all the signs that she made spontaneously during a day. As her vocabulary grew, the Gardners started from the 16th month of the project with sampling. This was done at least twice each day, by having two different observers record whether or not all signs on a checklist of the

vocabulary had occurred, and have them give some detail on the context, form and the kind of prompting involved. Later this procedure was stopped and formal drill sessions were conducted every day, in which the signs that had been learned would be elicited. These were the obligatory context sessions (described in section 2.1.5.).[27]

Motion picture, videotape and photographs were also used to record the chimpanzees' signing (Gardner et al., 1989). However, the published use of these permanent records was limited to the modulation study with Dar, described in section 2.2.4. (Rimpau, Gardner & Gardner, 1989).

When the Gardners used the daily checklists described above, these only showed what signs had been used by Washoe on that day and the context within which these were used. However, there was no further information. There were no data on the frequency of each sign, nor of the combinations of signs produced. Therefore, they came up with the idea to collect comprehensive samples of Washoe's sign use. This could then also be used to compare it with samples of human children's language. In these comprehensive samples a human observer would speak on a miniature cassette-recorder everything that Washoe signed, all that was signed by the humans, as well as the events and contexts within the signing occurred. They did not use film or videotape for these samples, "because the intelligibility of signs depends upon the angle of view" (p. 142). A static camera might not always capture the best interpretable images of the chimpanzee's signs. The Gardners did not want to restrict Washoe in her movements so that filming could be used, because then it would not be a representative sample of her sign use. Therefore they used a human observer reporting on audiotape, as he or she could move about so that the right angle could be taken to see the signs well. Starting in November, 1968 (month 29 of the project) they collected comprehensive samples of Washoe's signing for a period of 15 to 20 minutes once each month. The situation they recorded in the samples was usually the supper meal. But other

[27] Though it appears that in the later stages there were only formal ways of recording Washoe's use of signs, interesting spontaneous usages by Washoe were still recorded in the field records throughout the whole project.

situations were also recorded: routine events such as bedtime preparations, play sessions, including play with toys, and games such as tickling.

Formal tests.

Besides recording observations made during daily, natural interactions between the humans and the chimpanzees, and the more formal procedures such as the obligatory contexts, there were two kinds of formal tests that were administered to Washoe and the chimpanzees of the Gardners' second project. One of these was testing the chimpanzees' use of object signs by presenting them with (pictures of) the objects to which the signs referred, under double-blind conditions. The other consisted of tests in which the chimpanzees were asked different sorts of Wh-questions to which they had to respond appropriately. These tests will be described in extensive detail in sections 2.1.5.2. and 2.1.5.4.

The success of Project Washoe.

After four years and three months (51 months total) Project Washoe stopped on September 30, 1970. The project had been very successful. In contrast to the many failures of the spoken language experiments, the Gardners' attempt with sign language had worked. Washoe had acquired signs and she used them appropriately. At the end of the project she had a signed vocabulary consisting of 132 signs. Her vocabulary included signs for objects, actions, attributes, names, traits, and several kinds of markers. She spontaneously combined these into sequences of two signs and more. She even appeared to have rules of order with which she combined the signs. In the next chapter all of the results of Project Washoe will be discussed extensively.

The success of Project Washoe inspired other studies. In particular the research by Francine (Penny) Patterson with the signing gorillas Koko and Michael, and that of Lyn

Miles with the signing orangutan Chantek .[28] It also motivated Herbert Terrace of Columbia University to set up his own project, with the signing chimpanzee Nim Chimpsky. The results of the Gardners' work were also of considerable influence for the Rumbaughs' work with common (Sherman and Austin) and pygmy chimpanzees (Kanzi and others).[29] Thus, for the whole field of ape language the Gardners' Project Washoe has been of utmost importance.[30]

Second project of the Gardners: Moja, Pili, Tatu, and Dar. 1972 – 1980.

Stimulated by the success of their first project, the Gardners decided to set up a second project (Gardner & Gardner, 1975b, 1978, 1980, 1989a). This subsequent project had the advantage of being able to improve on some of the aspects of the original project with Washoe. It had the following differences in comparison with Project Washoe.

First of all, rather than having a single chimpanzee being cross-fostered and living with humans only, the second project was set up so that eventually four young chimpanzees would live together with the Gardners and their assistants. This allowed for plenty of interaction among the chimpanzees themselves and gave the opportunity to see the chimpanzees use their signs not just to communicate with humans, but possibly also with their fellow chimpanzee companions.

A second difference of the project was the age of the subjects. Washoe had been estimated to be between 8 and 14 months of age when her project started in September 1966. When they first set out to teach signs to a chimpanzee the Gardners had preferred to use a younger subject, but they explained that newborn chimpanzees were quite scarce and none were offered to them at the time that they wanted to start their first project (Gardner &

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[28] For descriptions of their research and findings, see the following references: Miles, 1978, 1983, 1990, 1993; Patterson, 1978, 1980; Patterson & Cohn, 1990; Patterson & Gordon, 1993; Patterson & Linden, 1981.

[29] See these references for descriptions of their work: Greenfield & Savage-Rumbaugh, 1990; Rumbaugh, Savage-Rumbaugh & Gill, 1978; Savage-Rumbaugh, 1986; Savage-Rumbaugh & Lewin, 1994; Savage-Rumbaugh, Murphy, Sevcik, Brakke, Williams & Rumbaugh, 1993; Savage-Rumbaugh, Rumbaugh & Boysen, 1978; Savage-Rumbaugh, Shanker & Taylor, 1998. In Chapter 5, the findings on Kanzi's use and comprehension of lexigrams will be presented and compared to the signing of chimpanzees.

Gardner, 1971, 1989a). During the first 8 to 14 months of her life then, Washoe had had no exposure to language nor had she been living in conditions that were comparable to that of a human child. This was in effect a disadvantage of Project Washoe. It lessened the comparability with a child, who is part of a human family and exposed to language from the time it is born. This exposure from birth onwards might have an important influence on the language development of a child. If so, such influence would be absent in the case of Washoe, since the first 8 to 14 months of her life she had had no exposure to language, but lived in the wild with her nonhuman family. Though the Gardners were very successful in teaching Washoe signs, they concluded that it was important to have chimpanzees exposed to language and human rearing conditions from more or less the time of their birth. Only then could the full effect of language exposure from birth on be captured. Having newborn subjects would also increase the comparability with language acquisition in human children.

The Gardners therefore decided to acquire four newborn chimpanzees. They arrived at the Gardners in Reno within a day or several days after they were born. They came from different laboratories and primate institutes across the United States. The female Moja (which is the Swahili word for "one") was the first to be obtained by the Gardners. She arrived a day after her birth, which had been on November 18, 1972. They proceeded to wait for about a year before the next subject was obtained, and then had similar intervals between the arrivals of the two later subjects. Pili (Swahili for "two"), a male, was born on October 30, 1973 and also came to Reno a day later. Pili later appeared to be suffering from leukemia and died after two years. On January 2, 1976 the female Tatu ("three" in Swahili) arrived with the Gardners. She had been born several days before, on December 30, 1975. Finally, the male Dar (in reference to Dar es Salaam, the capital of Tanzania, home country of many chimpanzees) was born on August 2 in 1976 and became part of the Gardners' group four

[30] Jane Goodall (1986) has described its importance as follows: "The project made history. It is impossible to overemphasize the value of the contribution the Gardners have made to our understanding of the chimpanzee mind" (p. 11).

days later.[31] After the arrival of Tatu, the Gardners moved from their suburban home to a former ranch where the chimpanzees were each housed in a cabin of their own.

Because of the intervals between arrivals, there were age differences within the group. This was exploited for the purpose of their language and general education. In human families, children learn from their older siblings. From Goodall's work and that of others the Gardners had also learned that in the wild, chimpanzees have close bonds with their siblings and that they learn from each other. The younger sibling learns from the older. The age differences in their own group of signing chimpanzees were therefore deliberately created. In that way, the Gardners thought to capitalize on the special learning relationships between younger and older siblings that also exist in wild chimpanzee families.

A third major difference of the second project with Project Washoe, was that there were now many more teachers and assistants that were more fluent in ASL. Several of these were born deaf, or had grown up with deaf parents. Some of them were native ASL users. Others had learned ASL and had used it extensively within the deaf community. The humans in Project Washoe (including the Gardners themselves) had been less fluent in their use of ASL.

The four new subjects were cross-fostered in the same way that Washoe had been (see above). They too were provided with toys.[32] Amongst these were balls, building blocks, wigs, masks, toy animals, and balloons. The cross-fosterlings also were taken for rides in wagons and sleds, and were allowed to play on a swing. Other play with humans included chasing, tickling, and playing hide-and-seek. The humans sometimes would also playfully squirt them with a watergun, or be pretending to fight an imaginary bogeydog. They were also given marking implements, such as pens, pencils, crayons and chalk, with which they scribbled on

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[31] Moja was born at the Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP) in New York. Pili at the Yerkes Regional Primate Research Center in Atlanta, Georgia. Tatu was born at the Institute for Primate Studies in Oklahoma. Lastly, Dar was born at Albany Medical College of the same Holloman Air Force Base in New Mexico from which Washoe had been sold to the Gardners (Gardner & Gardner, 1989a).

[32] The information on the specifics of the cross-fostered lives of the chimpanzees in the second project can be found in Gardner & Gardner (1978, 1984) and Drumm, Gardner & Gardner (1986).

paper. Sometimes they even named their drawings. Moja called her first drawing BIRD, after a human asked her WHAT THAT?[33] The chimpanzee subjects also used mirrors to look at themselves. They were even allowed to watch television. Several household chores were readily imitated by them, such as washing clothes, sewing, weeding the lawn, and making repairs with hammers and screwdrivers. The new cross-fosterlings also put up and removed window curtains, put trash in the trash can and cleaned up spills, sinks, and tubs. Besides learning to use human toilets (each cabin had one of its own), they even learned to wipe themselves and flush the toilet.

The same teaching methods as in Project Washoe were used with the newborn chimpanzees. However, with the improved conditions of the second project, and planning to keep the chimpanzees until they reached "intellectual maturity", the Gardners reasoned that they could "come much closer to describing the highest level of two-way communication that can be achieved by chimpanzees taught a form of human language" (1975b, p. 752).

The chimpanzees in this second project were also successful in acquiring signs. Indeed, enlisting them in the project a few days after birth had paid off. The chimpanzees started making and acquiring signs much earlier than Washoe. Moja and Pili made their first signs when they were only about three months old. When Moja was in the 13th week of her life she had an observed vocabulary of four signs: COME/GIMME, GO, MORE and DRINK. Pili had four observed signs by the 15th week of his life (DRINK, COME/GIMME, MORE and TICKLE). By their 13th week both Tatu and Dar had a vocabulary of five observed signs. Tatu's were GO, DRINK, MORE, UP and COME/GIMME. Dar's signs were MORE, TICKLE, COME/GIMME, UP and DRINK. In contrast, Washoe had only two signs (COME/GIMME and MORE) after six months of sign exposure (1975b). The new chimpanzee subjects also had an earlier age than Washoe of attaining a ten- and fifty-sign

[33] The Gardners (1978): "Since that time, Moja has labeled additional drawings that she produced and she has been consistent in the form of the drawing associated with a given label, e.g. radial shapes for *flower*, round forms for *berry*. .... Here sign language allows us to explore other systems of representation, which some child

vocabulary (Gardner & Gardner, 1978). By the end of the second project the chimpanzees had the following numbers of reliable signs in their vocabulary: Washoe had 133 signs,[34] Moja 168, Tatu 140 and, lastly, Dar had 122 reliable signs (Gardner et al., 1989).

II. The Fouts.

At the end of Project Washoe, Washoe was brought to the Institute for Primate Studies of the University of Oklahoma in Norman. Her main caretaker in the Gardners' project, Roger Fouts, together with his wife Deborah, went with her. Fouts had started off as the Gardners' research assistant in September, 1967 (Fouts, 1997). Soon he became their graduate student and carried out a study on the effectiveness of different teaching methods to obtain his Ph.D. in 1970 from the University of Nevada (Fouts, 1972). A description of that study and its results is given in Chapter 3.3.

Oklahoma 1970 - 1980.

The Institute for Primate Studies (IPS) of the University of Oklahoma was located in a rural setting about five miles outside of the city of Norman. Fouts had been appointed to the IPS as a Visiting Assistant Professor and Research Associate (Fouts, 1997; Fouts, Fouts & Van Cantfort, 1989). In Oklahoma Washoe was integrated into the chimpanzee colony of the IPS, directed by the clinical psychologist Dr. William. B. Lemmon (Fouts, 1975a). She was housed in a building with a complex of interconnected enclosures, together with about 25 other chimpanzees. The site also included a constructed one-quarter acre island surrounded by a moat, where young chimpanzees stayed (Fouts, 1997; Fouts & Fouts, 1993; Fouts et al., 1989). Eventually Washoe also lived on this island. Fouts (1994) explains the reason for the move to Oklahoma as follows: "We saw the IPS as an opportunity to expand the horizons in

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psychologists have identified as the start of writing" (p. 72). Indeed, when Moja was three years old, she received "half-hour daily school sessions" which included "formal practice on making letters" (p. 71).

[34] Note that the number for Washoe is different from the 132 signs the Gardners mention in other publications. It is unclear why this difference exists.

regard to signing chimpanzees. We could now address questions that were impossible to answer in Reno." They could see if other chimpanzees could learn the signs and even find out whether chimpanzees would use signs to communicate amongst themselves. In Oklahoma, Fouts continued teaching signs to Washoe and kept records on her progress. For example, by June 1974, Washoe's reliable vocabulary had increased to over 160 signs (Fouts & Rigby, 1977). Fouts also carried out several studies in which he taught and analyzed the use of signs by several other chimpanzees of the institute.

The chimpanzees Booee, Bruno, Cindy, Thelma, and the orangutan Foots.

The first of these studies involved teaching ten signs to four other chimpanzees (Fouts, 1973; Fouts & Couch, 1976). These chimpanzees were Booee, Bruno, Cindy and Thelma.[35] Their age at that time ranged between 32 and 51 months. Two of them, Booee and Bruno, had been home-raised as well. Booee for 30 months, and Bruno 24 months (with an additional eight months of "partial home-rearing", the nature of which does not get explained). After their time with humans, they were housed on the chimpanzee island of the IPS. The purpose of this study was to demonstrate that the acquisition of signs was not something particular to a maybe exceptionally bright Washoe, but was within the possibilities of other chimpanzees as well.[36] Fouts used moulding to teach the four chimpanzees the following ten signs: HAT, SHOE, FRUIT, DRINK, LOOK, KEY, LISTEN, STRING, FOOD, and MORE. All four chimpanzees were successful in learning these signs (Fouts, 1973).[37]

Fouts (1975b; Fouts, Shapiro & O'Neil, 1978) also did a short exploratory study in which he taught signs to an infant male orangutan called Foots. This was successful, because

[35] Tatu was the daughter of Thelma.
[36] Note that this study started before the Gardners had begun their second project with four new chimpanzees.
[37] Interesting further information about this study is given in Fouts & Couch (1976). Here the mean times for acquiring a sign are given for the four individuals. Booee's mean time of acquisition was 54 minutes, Cindy's 79, Thelma's was 136 minutes, and Bruno's 159 minutes. For all chimpanzees combined, the time necessary for a sign to be acquired ranged from 9.7 to 316 minutes.

the orangutan acquired several signs, such as DRINK, FOOD and TICKLE, and made combinations of two signs.

Chimpanzee to chimpanzee signing.

The existence in Oklahoma at the Institute for Primate Studies of a whole colony of chimpanzees, many of which were taught signs by Fouts, provided the opportunity to observe the possible use of signs by the chimpanzees amongst themselves.[38] Washoe used her signs to communicate with the other chimpanzees of the institute (Fouts, 1975a, 1997; Fouts et al., 1989). In order to further study the intraspecific use of the signs by the chimpanzees, Fouts increased Booee and Bruno's vocabulary from the 10 acquired signs to 36. This was done in the form of drills. Fouts then set up two situations to stimulate the signing between Booee and Bruno. The results of this study and further information on the chimpanzee to chimpanzee signing, are described in Chapter 2.4.7.

Lucy.

Roger Fouts also taught signs to the female chimpanzee Lucy. She was born in1964 in a colony of carnival chimpanzees. When she was two days old she was sold to Dr. Lemmon, who sent her to Jane and Maurice Temerlin, to cross-foster her, or raise her in species isolation (Fouts, 1975a, 1997; Couch & O'Neil, 1979). The Temerlins were connected to the Institute for Primate Studies. Maury was a psychology professor at the university and Jane was Dr. Lemmon's assistant.[39] They lived in Norman (Fouts, 1997; Linden, 1986; Temerlin, 1975). After two years of training by Fouts, who gave ASL lessons on his visits to the Temerlins' house, Lucy had acquired a vocabulary of over 80 signs (1975a).

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[38] Again, this opportunity arose before the Gardners could observe signing amongst the chimpanzees in their second project.

[39] The Temerlins were also Lemmon's patients in psychotherapy. Lemmon had the practice of sending off newborn babies at the IPS to his patients to care for them in species isolation. He thought that this had a therapeutic value for the patients, and at the same time it gave him the opportunity to study the effects of such cross-fostering (Fouts, 1997).

When Lucy was seven years old, Fouts, Mellgren and other assistants did the following study on her conceptualization of objects (Fouts, 1975a, 1975b; Fouts & Mellgren, 1976; Fouts & Rigby, 1977). It started as a generalization study to determine the effect of teaching Lucy a new sign, BERRY. Before teaching BERRY, Lucy was first presented with 24 different fruits and vegetables on each of four days and she was asked WHAT THAT? in order to name the edibles. She was then taught BERRY with a cherry as referent. Fouts and Mellgren wondered whether Lucy would spontaneously generalize the sign's use from berries to refer with it to different sorts of berries and berrylike items, such as tomatoes, peas and radishes. The result of the study was that Lucy only used BERRY to describe cherries on 12 consecutive test days. Her responses to describe the other edibles, however, led to some interesting discoveries. In 65% of her use of the sign SMELL she was naming citrus fruits (an orange, a lemon, a lime and a grapefruit). Fouts (1975b) suggests that Lucy "was probably referring to the rather pungent odiferous quality of the four citrus fruits" (p. 381). In 13 of 20 instances she signed PIPE to describe celery or pickles. In section 2.2.3. of this dissertation several other spontaneous creative uses of signs by Lucy will be presented.

Ally / Ali.

Ally (also known as Ali) was another chimpanzee in Oklahoma who was taught signs by Roger Fouts. He was born in October 1969 as the half-brother of Bruno (sharing the same father but a different mother). Like Lucy he was sent by Lemmon to a human to be cross-fostered. This was Sheri Roush. Ally had acquired 78 signs at an age of 37 months. Several studies were carried out with him (Fouts, 1975a, 1978a, 1997; Fouts & Couch, 1976; Fouts, Chown & Goodin, 1976; Fouts & Mellgren, 1976). In one study Ally learned ten new signs for English spoken words. Ally had also received exposure to spoken English and appeared to understand various words and phrases. In the study he was taught signs for the following spoken words: banana, curtain, foot, leaf, nut, pillow, raisin, shocker, spoon and water. This

was done in the absence of these objects, so Ally only learned the signs in reference to the spoken words. Later he was presented with objects that were the referents of these words, and he was asked to label them. Ally successfully transferred the signs he learned for the words to their referents (Fouts, Chown & Goodin, 1976). In a pilot study on this subject with Lucy, she correctly transferred the sign CAR that she had learned for the vocal word "car" to describe a toy car (Fouts, 1975a).

Another study was carried out on Ally's comprehension of novel commands to place five items in three different locations. Examples of these commands were PUT BABY (doll) IN BOX or PUT BALL IN PURSE. Ally was correct in 31% of his responses to novel commands, while chance responding would have produced a score of 7% (Fouts & Couch, 1976). A further study concerned the production of subject-preposition-location utterances. Ally was successful in correctly producing such sequences of signs. See section 2.2.4.1. for more discussion of this particular study.

Project Loulis 1979 – 1984.

Roger and Deborah Fouts set up yet another project that investigated the use of signs by chimpanzees even further. In this major project that would last more than five years, they wanted to study whether the signing chimpanzees would transmit the signing behaviour to their own offspring. This was one of the special plans of the Oklahoma time (Fouts, 1975a, Linden, 1974/1981).[40] Indeed, Fouts, Fouts & Van Cantfort (1989) present this plan as the "long range goal of the continuation of Project Washoe" (p. 280).[41] As soon as Washoe would give birth to a baby (who was housed at that time with several males in order to

[40] Another plan, that was apparently never carried out, was to encourage cooperative hunting behaviour among the chimpanzees by using signs. They would be brought together in an enclosure with a herd of sheep to hunt and kill. The signs used might shed some light on early human communication in the context of cooperative hunting (Hewes, 1973; Linden, 1981).

[41] The Gardners (1978) themselves mention that the new ranch facility for the chimpanzees in their second project gave them the possibility to monitor their sign use as they became adult, including possible teaching of their offspring: "This would permit us to work with the valuable adult subjects whose sign language training has been in progress for the longest time and who might participate in the teaching of their offspring" (p. 46). The

become pregnant), the humans would stop signing in the baby's presence, in order to see whether the baby would acquire signs from the other chimpanzees (Fouts, Shapiro & O'Neil, 1978).

In Oklahoma, Washoe gave birth to two babies. However, they died within only a few days, and several weeks, respectively (Fouts, 1997). After the second baby died, Washoe slipped into what appeared to be a depression. Two weeks later, on March 24, 1979, Roger Fouts was able to obtain a substitute child for Washoe from the Yerkes Regional Primate Center at Emory University in Atlanta, Georgia. This was the 10-month-old Loulis (named after his two caretakers at Yerkes, Louisa and Lisa).[42] Washoe took to the infant and adopted him soon. From Loulis' arrival in 1979 through June 1984, the humans no longer used signs in his presence, except for the following seven: WHAT, WHO, WHERE, WHICH, WANT, SIGN, and NAME.[43] They continued using signs with the other chimpanzees, but only when Loulis was not around. In Loulis' presence they communicated with the seven signs mentioned and by using spoken English, which the chimpanzees apparently understood to some extent (Fouts, Hirsch & Fouts, 1982; Fouts et al., 1989).

After being only eight days with Washoe, Loulis was already observed to produce a sign. This was the sign HAT/GEORGE, produced by contacting the top of the head with an open hand. Most of Loulis' learning of signs took place by observational learning or imitation of the other chimpanzees. Several observations were made, however, of active teaching on the part of Washoe (D. Fouts, 1989; R. Fouts, 1983a, 1987; Fouts & Fouts, 1993; Fouts et al., 1982, 1989). On one occasion, Washoe was observed to put a chair in front of Loulis and modeled the sign CHAIR/SIT to him five times (however, this sign was later never observed to be made by Loulis). In another incident, Washoe apparently moulded Loulis' hand into a

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chimpanzee subjects of the second project, though, were sent to the Fouts at the respective ages of seven (Moja), five and a half (Tatu), and four years and nine months (Dar).

[42] Loulis' mother could not care for him. She had probably been used in a brain stimulation experiment, since she had four metal bolts in her skull (Fouts, 1997).

[43] When by accident a human used other signs, the instance was recorded. During the course of the project there were fewer than 40 of such instances (Fouts et al., 1989).

sign's configuration. As a human was bringing food, Washoe signed FOOD/EAT repeatedly. She then stopped signing, took Loulis' hand (he was sitting next to her), and moulded it into the FOOD/EAT configuration (curved or tapered hand), even bringing it to his mouth for the proper movement of the sign. The conclusion of Fouts et al. (1989) is that "as in human language acquisition ... the chimpanzee mother actively taught her offspring" (p. 291).[44] At the end of the project, in June 1984, Loulis had a vocabulary of 51 signs and had been observed to make combinations of signs (Fouts et al., 1989).

The Fouts concluded that their Project Loulis had demonstrated cultural transmission of a human language by chimpanzees (Fouts, 1994, 1997; Fouts & Fouts, 1993; Fouts et al., 1982; Fouts, Jensvold & Fouts, 2002). Indeed, it has been described as "ASL acquisition by an infant chimpanzee from his mother" (Fouts et al., 1982, p. 189). Loulis has since been presented as a unique chimpanzee that acquired a human language (American Sign Language) from another chimpanzee (Fouts, 1983b), and as "the first nonhuman to learn a human language from another nonhuman" (Fouts, 1997, p. 244).

Ellensburg, Washington. 1980 – Present.

In September 1980 the Fouts moved to Central Washington University (CWU) in Ellensburg, in the center of Washington state. The major reason for this move was that great improvements could be made there in the housing conditions of the chimpanzees with regards to their safety and health.[45] The Fouts had with them Washoe, Loulis, and Moja. (the Gardners had sent Moja away to Oklahoma in December 1979). The chimpanzees were moved in a double-long horse trailer. In May 1981 Tatu and Dar's stay with the Gardners ended and they were sent to the Fouts in Ellensburg. In this place the Fouts remained taking care of the five chimpanzees. They also continued the research of their sign use. Fouts' graduate students from CWU carried out several studies. The Gardners kept in touch and

[44] However, Fouts' 1987 words are that "very little tutoring" had been found.

their Ph.D. students visited the chimpanzees in Ellensburg to work with them and set up new studies.[46] Through lack of appropriate housing on the campus of Central Washington University the chimpanzees stayed in a compound of several rooms with connecting tunnels on the third floor of CWU's Psychology building. Plans and funding for a new building more suitable to the chimpanzees' needs were quickly set up. Eventually, a new special building was constructed to house the chimpanzees. In May 1993 the chimpanzees were moved to this new building. It had a large outdoor area and big indoor rooms and was named the Chimpanzee and Human Communication Institute (CHCI) (see Figure 1.1.). Here Washoe and the four other chimpanzees are taken care of up to this day in the loving dedication of the Fouts, their students and a large group of local and student volunteers.[47] Their use of signs also keeps being investigated by many students from all over the United States, and sometimes from overseas.

Many studies have been carried out in Ellensburg. Most of Project Loulis actually took place when the Fouts had already moved with their chimpanzees to Washington state. Other major studies included Debbi Fouts' work on the signing of the chimpanzee group among themselves when no humans were present. Private signing also became the focus of several systematic studies that investigated the nature of this form of signing, where the chimpanzees sign to themselves and are not communicating to others. A further major area of research has been the chimpanzees' pragmatic abilities and conversational skills in using their signs. One study looked at the imaginary (play) behaviour of the chimpanzees (Abshire, 1989).

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[45] See the Epilogue for a more detailed description of the problems the Fouts encountered at the IPS in Oklahoma.

[46] Central Washington University does not have a Ph.D. program, so the Fouts could only have graduate students working on their master's degree. Gardners' students from Reno went to Ellensburg to do the empirical work for their Ph.D. Sadly though, on June 15, 1995 Trixie Gardner died (Dewsbury, 1996), so from that time onwards it was Allen Gardner who continued this work by himself.

[47] Sadly, one of the five CHCI chimpanzees recently passed away. Moja died at the age of 29 on June 6, 2002, from the effects of an internal abdominal hernia.

Figure 1.1. Moja in the outdoor area of the new CHCI building, 1993. © Esteban Rivas

Remote videocamera study on chimpanzee-chimpanzee signing.

Deborah Fouts analyzed the signing by the chimpanzees amongst themselves. The study filmed the chimpanzees with three or four remotely controlled videocameras when no

humans were present.[48] This was done in order to prevent any possible cueing by humans. The sessions were filmed while the chimpanzees were confined to one enclosure during annual maintenance of the caging and floors. During filming humans did not enter "the chimpanzee quarters, surrounding hallways, and adjacent rooms" (Fouts & Fouts, 1989, p. 298). During the Summers of 1983, 1984 and 1985 Fouts collected 15 hours of remote videotaping each year. On 15 days within a period of three weeks three random samples of twenty minutes were recorded each weekday. The amount of interchimp signing varied. One sample contained 29 conversations of the chimpanzees with each other (D. Fouts, 1989, 1994; R. Fouts, 1987; Fouts & Fouts, 1989, 1993). The contents and nature of this specific kind of chimpanzee signing will be described in chapter 2.4.

Private signing.

The graduate student of the Fouts and later Ph.D. student of the Gardners, Mark Bodamer, carried out two extensive, detailed studies on the occurrence of private signing. In this use of signs the chimpanzees are signing to themselves, when no others are present or when they are not in communication with others. The Gardners had already noted this behaviour in Washoe. Bodamer did two systematic studies in which he filmed the private signing of the five chimpanzees and classified their private utterances to the communicative functions of private speech in human children. This research will also be described in more detail in chapter 2.4.

Pragmatic and conversational skills.

Several studies were carried out on the pragmatic and conversational abilities of the signing chimpanzees. Graduate student Vicki Kennerud compared the amount of spontaneous and imitative signing between a structured drill and a relaxed conversation setting. The Gardners' Ph.D. students Mark Bodamer and Mary Lee Jensvold studied in extensive detail the

[48] Part of this study was used to fulfill the requirements for her master's thesis in psychology, which Debbi obtained in 1984.

responses of the CHCI chimpanzees to different human conversational probes. Bodamer studied the initiation and maintenance of conversations by the chimpanzees. Jensvold expanded on this work and investigated the contingency or appropriateness of the chimpanzee responses to different types of human questions and reactions. These works are described in more detail in chapter 2.3.

III. Herbert Terrace and Project Nim. 1973 – 1977.

Now that we have introduced the Gardners and the Fouts and presented their projects with signing chimpanzees, it is time to introduce the only other project with a signing chimpanzee that has been carried out. In 1973 the psychologist Herbert Terrace set up his own project, independently from the Gardners. At Columbia University in New York he began Project Nim, with a two-weeks-old chimpanzee he named Nim Chimpsky, after the famous linguist Noam Chomsky.[49] The project took place from December 1973 to September 1977. Terrace, a former student of the behaviourist psychologist B.F. Skinner, had become quite enthusiastic by the "dramatic reports" on the results of ape language studies such as that with Washoe. He was hopeful to learn more about the chimpanzee's cognition and ability for language by undertaking a project of teaching a chimpanzee of his own (Terrace, 1979a, 1985a, 1987a).

Nim was born on November 21, 1973 at the Institute for Primate Studies in Oklahoma. He was a full brother of Ally. He was sent on loan to Terrace on December 3, when he was about two weeks old. He was first raised in the home of the family LaFarge, which had eight family members, on New York's West Side. There he lived for 21 months. From August 1975 to September 1977 he stayed at a large estate, owned by Columbia University. It was called Delafield and was located in Riverdale, in upstate New York. In the large house of Delafield Nim stayed with four or five long-term members of the project. For

[49] Terrace had first thought of calling the chimpanzee Noam Chimpsky or Neam Chimpsky. His colleague Tom Bever, however, "pointed out that from a linguistic point of view, if Chomsky was changed to Chimpsky, Noam should be changed to Niim or to its shorter equivalent, Nim" (1979a, p. 29-30). Terrace was also pleased about the "jungle quality" the name Nim had.

the main part of the time the supervision was in the hands of Laura Petitto, Terrace's major sign teacher at that time.

In the LaFarge household, as well as in Delafield, the humans communicated with Nim by using American Sign Language.[50] They also used signs to communicate with each other. Nim was raised as a human child in a human family. It was considered of utmost importance that Nim established social bonds while he was acquiring language. In these aspects, the environment in which Nim grew up was comparable to the "language immersion" environment the Gardners provided for their chimpanzees.

The major goal of Project Nim was to collect a large corpus of utterances, in order to be able to determine whether a chimpanzee could produce utterances that were actual sentences, that is, showing a structure that was governed by grammatical rules (Terrace, 1979a, 1981, 1983, 1985a; Terrace, Petitto, Sanders, & Bever, 1979, 1980). Terrace and his group thought that Project Washoe and several other language projects had adequately proven that apes could learn individual, arbitrary "words" or symbols. However, this was not the same as evidence of linguistic competence. Even dogs, rats, horses and other animals can learn individual symbols or "words" to obtain specific rewards. The next question therefore to investigate was whether apes could produce sequences of symbols, where the combination of the individual symbols would result in new meanings being conveyed. A sentence is defined by Terrace and his colleagues (1979) as characteristically expressing "a complete semantic proposition through a set of words and phrases, each bearing particular grammatical relations to one another (such as actor, action, object)" (p. 891). According to them, it is this ability to create sentences that is most distinctive of human language. Their main research question with Nim was therefore "Can an ape create a sentence?," which was the title of their

[50] Pidgin sign language would be a more accurate term. Pidgin sign is a form of communication in between actual ASL and signed English. It uses signs from ASL, but applies the word order of English, though without grammatical morphemes such as -ed and -ly. It is difficult for hearing persons to achieve full use of ASL, so pidgin sign is a better characterization for what the humans in project Nim used. Actually, the same is possibly applicable to the human signing in the Gardners' projects, though their second project had more native ASL signers.

most influential article, published in *Science* on November 23, 1979. Though Terrace was excited about the prospects of Project Nim, he was at the same time somewhat skeptical that the sequences signing apes produce might be considered as sentences. He also doubted that apes, in contrast to human children, would have a motivation in using symbols that would go beyond the satisfaction of their immediate and basic needs (1979a).

Besides analyzing the grammatical competence of a nonhuman ape, Terrace (1979a, 1985a) was also hoping to learn through the communication in signs how a chimpanzee thinks and views the world: "Aside from telling us about basic emotions and feelings, the chimpanzee might also tell us about its memories of pleasant and unpleasant events, its hopes for the future, and its preferences and dislikes" (1979a, p. 8). New knowledge and information might be obtained that could not have been thought of before the language projects with apes.

The methods used to teach Nim signs were comparable to the Gardners' in that a mixture of methods was used. The basic method in Project Nim was modeled after the guidance or moulding technique used by the Gardners and Fouts. When Nim was about 10 months old, Carol Stewart was hired as his principal sign teacher. She tried to teach Nim the separate parts of the signs in a rather rigorous manner of behaviour modification, by rewarding him for correct behaviour. Signs were taught by Stewart in three stages. The first stage was called "reception," during which Nim had to show comprehension of the sign's meaning by making an appropriate response or behaviour. In an example of such comprehension from Terrace (1979a), the teacher signs EAT and Nim should then pick up a piece of food or select a picture of some food item from a group of varied pictures. During "production," Nim was then taught how to make the sign by use of moulding, though outside of the sign's appropriate context. Stewart did this so Nim would not be excited or distracted by presence of the object or item to which the sign referred to. In the final stage, called "expression," Nim was taught to associate and produce the sign in the appropriate context,

such as in the presence of the object the sign referred to. Stewart's method was, however, supplemented by a diversity of other methods. The other teachers continued using more relaxed methods and stressed communication and modeling. Terrace thought of Stewart's method as a limited one and therefore applied an approach where multiple methods were allowed, calling this approach an "eclectic" one (Terrace, 1979a).[51] Nim received many sign lessons in a classroom that was specially built for him in the Psychology building of Columbia University. It was a small room of about eight square feet. It had a one-way mirror on one of the walls through which Nim could be observed, photographed and filmed by humans without being seen by him. The classroom was kept bare in order to minimize distraction and keep Nim's concentration and attention focused on the sign lessons, though play and breaks from lessons were part of his stay on campus as well (Terrace, 1979a; Terrace et al., 1979, 1980).

Datacollection in Project Nim was carried out in several ways. Audiotapes were used, where Nim's teachers would whisper into a miniature cassette recorder what he signed and whether these signs were spontaneous, imitated or prompted by the humans. The teachers then transcribed these tapes as soon as possible. Occasional reliability checks were executed where a second observer watched through the one-way window of the classroom. The second observer's report was then compared with that of the teacher's, which usually showed an almost perfect agreement (Terrace, 1979a). Film and videotape were also used. The analysis of these filmed records eventually was to become of pivotal importance, as will be discussed shortly.

In New York, Nim had a stable environment living with the LaFarge family. In Delafield too, he lived with his residential teachers. However, some of these left the project and it became increasingly difficult to have enough semi-permanent teachers. By September 1977 it became clear that the project did not have the financial resources to provide Nim with

[51] Stewart, displeased with this eclecticism, that in some respects directly compromised her method, resigned as Nim's main teacher after six months and eventually left the project altogether two months later.

permanent human companions who could also function as his teachers. The Terrace team therefore decided to send Nim back to Oklahoma and end the project. At the end of the project, Nim Chimpsky had acquired 125 individual signs, the majority of which were signs for objects (Terrace, 1981, 1984; Terrace et al., 1979). He started making combinations of signs at the age of 16 months, the first being MORE DRINK and MORE EAT. More details on his sign use will be presented in the next chapter.

When Nim was returned to Oklahoma, Terrace's team carried out a detailed examination of the sessions that had been captured on videotape. They did an important discourse analysis of the chimpanzee's interactions with the humans. The results from this analysis eventually showed a different picture of chimpanzee signing than the one the Gardners and Fouts had been putting forward. The videos showed that Nim was imitating the human's signs at an unsuspectedly high rate. This important discovery put into peril the conclusions on ape signing that had been reached using unfilmed, nonpermanent data. The evidence for structured combining of signs was now compromised because imitation had not been excluded in these records. Other patterns that were found in the analysis of Nim's signing were a high prominence of a small set of seven signs that Nim made very often. These signs, NIM, ME, YOU, EAT, DRINK, MORE and GIVE, could be appropriate in almost any context and were therefore called wild card signs. They were interpreted to show that Nim used a strategy in which he relied on these wild cards in order to please and manipulate his human companions. Nim's multiple-sign sequences were constructed by repeating signs and adding redundant signs. They did not convey more information than the shorter utterances. There was thus no justification to interpret his combinations as sentences. In terms of motivation, the chimpanzee signing could be termed "acquisitive" in that its main function was to obtain things from the humans. In general then, the linguistic abilities that had been ascribed to the signing chimpanzees only seemed to be there. The apes in the

projects had merely learned a way to get what they wanted, by using strategies that gave the appearance of conversational ability in their signing.

The ape language controversy.

The publication of the Terrace's team's analyses led to a debate on the signing chimpanzees that has become known as the ape language controversy.[52] The Gardners and Fouts disagreed strongly with Terrace's conclusions.[53] They criticized the methodology and design of Project Nim in order to explain the different results that this project had come up with. Much discussion took place on the characterization of ape signing as language, and the comparability of the chimpanzees' utterances with those of young human children in their earliest stages of language acquisition. The debate was heated at times. The controversy found its culmination in the Clever Hans Phenomenon Conference, held in May 1980. This conference was organized by the linguist Thomas Sebeok, under auspices of the New York Academy of Sciences. Sue Savage-Rumbaugh,[54] present at the conference, describes the atmosphere as "very negative." She says that "the issue was effectively prejudged" (p. 50), the conference centering on a characterization of ape language research as a practice of (self)deception (Savage-Rumbaugh & Lewin, 1994). In a report for *Science* Wade (1980) describes the press conference at the end of the Clever Hans meeting. There Sebeok raised the question of fraud: "In my opinion, the alleged language experiments with apes divide into three groups: one, outright fraud; two, self-deception; three, those conducted by Terrace."

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[52] Wallman (1992) has outlined why it is appropriate to speak of an actual ape language *controversy*. He explains that every scientific argument has at least two elements: a minimum of two irreconcilable positions regarding the subject in question and "an intensification of the normal emotional investment of the scientist in his or her position, due in some measure to the contending itself but perhaps also related to the ideological significance of the subject within the larger society" (p. 4). When such an argument takes place in combination with suggestions of fraud or quasi-fraudulent procedures, then one speaks of a controversy. The ape-language debate then, is "an exemplary" controversy.

[53] Wallman (1992) calls Terrace the "bête noire" of the ape language controversy, because of his conclusion that Nim and the other signing apes were not capable of producing actual sentences. Another name for Terrace has been the "whistle-blower" (Pinker, 1994). In a review of Terrace's 1979 book *Nim*, which contains the most important conclusions of Project Nim, E.W. Menzel Jr. (1981) describes it as a book that "will no doubt produce joy among 'chimpophobes' and outrage among some 'chimpophiles'" (p. 427).

[54] Sue Savage worked with the signing chimpanzees and the Fouts in Oklahoma. Later she was to study the use of lexigrams by common and bonobo chimpanzees with Duane Rumbaugh, whom she married.

Two psychologists studying deception said they expected the level of fraud to be the same as in any other field of research. However, "all refused to answer the question of whether they possessed any positive evidence of fraud" (p. 1351).[55] This is probably the only time that blunt fraud has been so openly suggested in the ape language controversy. Note that this presentation of the suggestion of fraud should not be mistaken for a truthful final conclusion on the work of the Gardners and Fouts. It is only reported here because it is a part of the history of the ape language controversy.

Whether these criticisms were correct or not, the negative conclusions of the scientific community on the evidence for linguistic abilities in the signing chimpanzees, led to a large extent to the discredit of the work of the Gardners and Fouts. Funds dried up for this type of research which sometimes threatened the continuation of their projects (Fouts, 1997). A large degree of isolation within the academic community also was their share.[56] Through perseverance and dedication to their chimpanzee subjects, they held out and struggled for new resources to secure their care and the continuation of the research.

The history of the research with signing chimpanzees has now been described. The different projects and their researchers have been introduced. Their main findings and conclusions have been summarily presented. It has also been shown that the research ended up in an actual controversy. Chapter 2 will now present in more detail the results and debate on the signing of the chimpanzees. This presentation will clarify the exact differences of results and opinion between the different investigators. In Chapter 3 the discussion will then center on

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[55] In the same article Wade depicts the ape language controversy as "a series of mutual criticisms ... which have made the War of the Roses look like a teddy-bears' picnic by comparison" (p. 1349). Linden (1981) calls the Clever Hans meeting, a "witch-hunt" conference. According to Linden, Sebeok suggests in his writings as well as at the conference

> that all the evidence accumulated over the past fourteen years about ape language capacity has been a *fata morgana* produced by scientists seeing what they want to believe and sidetracked by the fame and monetary rewards that dramatic results can bring. (p. 291)

[56] In a book on the use of apes in research, Deborah Blum (1994) called her chapter on Roger Fouts "The Outsider."

the methodology and design of the projects. It will point out certain problems of method and interpretation that are at the heart of the ape language controversy.

To end this chapter, Table 1 shows the chronological timeline of the different projects with signing chimpanzees, with their exact times of beginning and ending.

Table 1. Timeline chimpanzee sign projects

Year	Project Washoe	Gardners' 2nd project	University of Oklahoma	Central Washington University	Project Nim
1966	Start on June 21				
1967					
1968					
1969					
1970	End on Sept 30		Arrival Washoe & Fouts: October		
1971					
1972		Nov 19: Moja arrives			
1973		Pili arrives			Dec: Start
1974					
1975		Pili dies			
1976		Tatu & Dar arrive			
1977					Sept: End
1978					
1979		December: Moja leaves	March 24: Loulis arrives. December: Moja arrives.		
1980			Departure in September	Sept: Washoe, Moja, Loulis & Fouts arrive	
1981		May: Tatu & Dar leave		May: Tatu & Dar arrive	
PRESENT					

CHAPTER 2

THE RESULTS OF THE PROJECTS WITH SIGNING CHIMPANZEES

In this chapter the nature of the chimpanzees' sign use will be outlined by drawing from the results of the different projects. In section 2.1. on the individual signs that the chimpanzees acquired, the following subjects will be examined. First, a closer look will be taken at the different criteria by which the investigators determined that a sign had been acquired by the chimpanzee. After a few remarks on the glosses that were given to the signs, the semantic categories of the signs acquired by the chimpanzees will be presented. This will give some insight on the particular kinds of signs that were actually learned by the chimpanzees: object signs, action signs, request markers, person signs, and others. An exhaustive listing of the semantic categories and the individual signs included in them is presented in several tables. The methods by which signs were classified into semantic categories are also presented. This section on individual signs will be ended by a discussion on the published information on the frequency of the particular signs that were used by the chimpanzees.

In section 2.2. of this chapter, the combinations of signs that the chimpanzees produced will be examined in detail. The findings of the different projects on the semantic and grammatical structure of these sequences will be presented. Mention will be made of possible semantic relations expressed in the sign combinations, the use of creative combinations to describe new objects, and the presence of sign order or inflectional devices to modify the meaning of an utterance. Lastly, the nature of multiple-sign combinations will be examined.

Section 2.3. will center on the discourse and conversational nature of the interactions between the chimpanzees and humans in the projects. The extent of spontaneous signing will be described and their ability for turn-taking. The amount and role of imitation by the chimpanzees of human signs will be extensively discussed. Other conversational phenomena will also be mentioned.

The subject of section 2.4. will be the communicative intentions underlying the signed utterances of the chimpanzees. The nature of their motivation to use signs will be assessed by looking at different kinds of communicative intentions, such as requesting objects and actions, naming objects and pictures, expressing internal states and others. The discussion among the different groups of signing ape researchers will be presented in detail.

Finally, in section 2.5. the opinion of the different researchers will be given with regards to the language question: Looking at the results of the projects, can the signing behaviour of the chimpanzees be assessed as linguistic or not?

A note should be made here about the way in which throughout this dissertation the findings and conclusions of the Gardners and Fouts are compared to those of Terrace and his team. It should not be taken to imply that any of these researchers have better conclusions or that some are always wrong in their claims. It is simply a consequence of the fact that there have only been two different groups of researchers that set up projects with signing chimpanzees. The fact that their results and conclusions differed from each other, makes a detailed comparison of the two groups an excellent way in which to discuss the different aspects of the chimpanzees' signing behaviour. It is for this reason then, that in this dissertation the conclusions of the Gardners and Fouts are set against those of Terrace and colleagues. In fact, chapters 2 and 3 can be seen as a comparative study of the results and conclusions of the Gardners and Fouts with those of Terrace and his team.

A further note regards the nature of chapters 2 and 3. In chapter 2 the findings and conclusions of the different researchers are presented. In order to clearly present these the

author has attempted to refrain from adding new criticisms or arguments to the discussion between the two groups in the debate. Additional remarks and criticisms will be reserved for chapter 3.

1. SIGNS

All chimpanzees in the different projects acquired signs and employed these in their daily communication and interaction with their human caretakers.[57] Each individual chimpanzee acquired a vocabulary consisting of many different signs that were an active part of their signed communications.

1.1. Acquisition criteria.

When a sign was made by an ape, it was not easily or routinely considered to be an acquired sign. In all the projects care was taken to use strict criteria with which to determine the developing acquisition of the signs. The first criteria were set up by the pioneers in these projects, the Gardners. These were later somewhat modified by Terrace.

The Gardners constructed two criteria: one for an observed sign and one for a reliable sign. For a sign to be an *observed sign* the following conditions had to be met. The sign had to be made spontaneously by the chimpanzee. This meant that it had to be made without any form of informative prompting, which is defined by Gardner, Gardner and Nichols (1989) as "direct modelling or guidance that could have induced any portion" of the sign (p. 83). The sign also had to be well-formed, and be appropriate to the context. Appropriateness meant that the sign had to be "prompted by the verbal and situational context, and by the presence of a suitable addressee" (p. 83). This spontaneous, well-formed and appropriate use of the sign had to be observed by three different humans, separately from each other on different

[57] Note that the use of the term "sign" throughout this dissertation does not imply anything more than a simple reference to the behaviour that the chimpanzees in the projects learned to produce with their hands. It is not used to imply an equivalence with a sign as it is used by humans or with signs from official sign languages such as American Sign Language.

occasions. Observed signs were not yet reliable signs, though. They were candidates for reliable signs. Only reliable signs were considered to be active and substantial parts of the chimpanzee's sign vocabulary. The Gardners set up the following criterion for a *reliable sign*: the sign had to be made spontaneously, well-formed, and appropriately, but it also had to be produced every day for a continuous period of 15 consecutive days. This criterion of a continuous period of sign production was applied conscientiously and strictly. If the chimpanzee failed to make a sign on any one of the 15 days, say the chimpanzee did not produce the sign on day 12, then the production of the sign on the previous 11 days could not be included for the fulfillment of the 15-day criterion. If the chimpanzee failed to make the sign on one day, the whole counting procedure had to start all over, beginning the next day as day 1 again.

Terrace used a slightly less strict criterion than the Gardners (1979; Terrace, Petitto, Sanders & Bever, 1979). He did not divide signs into observed and reliable signs. Instead he talked about *acquired* signs. His acquisition criterion, however, was in fact a combination of the Gardners' criterion for an observed and a reliable sign. With Nim, three different observers on separate occasions first had to observe the spontaneous production of a sign. This had to be spontaneous in the sense that it did not follow human moulding, prompting or modelling of the sign by the human immediately prior to the criterial observation. Also, as with the Gardners, the sign had to be made in its appropriate context. Then there was also a continuous period of successive days in which the chimpanzee had to make the sign each day. However, in contrast to the Gardners, Terrace was satisfied with five consecutive days in which the sign was observed to be produced by the chimpanzee.

The acquisition criterion that the Fouts used for Loulis' signs was considerably reduced in comparison to the Gardners' criterion (D. Fouts, 1989; R. Fouts, 1994; Fouts, Fouts & Van Cantfort, 1989; Fouts, Fouts & Schoenfeld, 1984). A sign was counted to be within Loulis' vocabulary if three different observers on separate occasions saw him make

the sign in the appropriate context. This transformation of the Gardners' criterion for an observed sign into a reliable sign was explained as having been introduced because "the reliability criterion of 3 different observers for 15 consecutive days was impossible to obtain under the cultural transmission study" (Fouts et al., 1984, p. 2). The 51 signs Loulis had acquired at the end of the project in 1984 were not specified into reliable and observed signs (Fouts et al., 1989). His official sign checklist of September 1998 does make this distinction. By this time, his acquired signs numbered 77. They consisted of 10 reliable signs (with YOU, THAT and THERE considered as the same sign), and 67 observed signs.[58]

1.2. The gloss of the signs.

The signs that were taught to the chimpanzees were mostly based on or directly taken from the signs of the American Sign Language. For many signs in the projects, the PCM as well as the sign's meaning were taken from the ASL equivalents. Other signs diverged more strongly from ASL signs, and still others were wholly invented. Each sign was then given an English gloss or name. The gloss was arrived at by an approximation of the best equivalent English word. The gloss that was given to a sign was determined by the chimpanzee's general usage of that particular sign. Thus, a sign that was made when requesting or describing popcorn, was glossed as POPCORN. The sign that was made to describe a hairbrush and to ask for the action of brushing, was glossed as BRUSH.

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[58] An official criterion for what an observed sign would be for Loulis has not been given in the publications. However, Roger Fouts wrote the author the following explanation: "With Loulis and under the conditions we were and are studying Loulis, we found that the first criterion [for an observed sign] could be easily met over time. However, since he is the primary initiator of his signing as well as his fellow chimpanzees, we found that to try to set up something that would elicit a sign for 15 consecutive days was too artificial and interfered with his interactions with his fellow signing chiimpanzees. So we used the "three observers" criterion. However, some of his signs he does use almost every day. We record these on his check list, and when he uses one 15 days straight we then move it to the top of the check list. So all the signs on his checklist are reliable, but only for the three observer and correct context criteria. The top ones have met the 15 day criteria quite independent of anything we've done," (personal communication, April 29, 1994). Thus, the 10 reliable signs on his 1998 checklist have met the Gardners' 15-day criterion for reliability, while the 67 observed signs were all observed at least by three different observers on three different occasions. This is thus the same distinction between signs that was used for the cross-fostered chimpanzees.

In the study in which Fouts taught ten signs to Booee, Bruno, Cindy and Thelma (see chapter 1), yet another acquisition criterion was used. Answering a human question, usually WHAT THAT? with the correct sign for five consecutive times was sufficient in this particular study (Fouts, 1973; Fouts & Couch, 1976).

The published descriptions of the usage of the signs by the chimpanzees show that not for all signs the use corresponded to the meaning of the English gloss they were given. For example, as was mentioned under the heading *Chimpanzee signs* in chapter 1, the sign BERRY (based on the ASL sign STRAWBERRY) was used to refer to all sorts of small fruits, not just berries, but also cherries and grapes (Gardner & Gardner, 1975). The Gardners (1980) specifically refer to this discongruence when they explain that "the meanings intended by our immature chimpanzee subjects should not be confused with the meanings intended by [human] adult signers or adult speakers, when the latter use English words that are the equivalents of the signs" (p. 352). They then mention that

> most of the investigators who have undertaken to teach language to apes, and particularly most of the commentators, have failed to distinguish between the usage of the subjects and the usage of fluent adults when speaking the English words used as glosses for the vocabulary items. We Gardners have maintained this distinction explicitly throughout our articles. (p. 353)

For the Gardners then, the gloss is a guide to the interpretation of a sign, and not its meaning set in stone. In the end, "all we know [about the chimpanzees' signs possible meaning] is what we can observe of the contexts in which they use their childish vocabularies," (Gardner et al., 1989, p. 63). However, the Gardners do not want to imply that there is no link at all between the English gloss given to a sign and its intended meaning or use by the chimpanzees. They say that even though infant usage can be "either narrower or broader than adult usage. Nevertheless, the chimpanzee usage had to have some major overlap with adult usage" (1985, p. 164).

1.3. Semantic categories of acquired signs.

Like every word, each sign of a language belongs to a certain specific category of meaning, or semantic category. Some signs refer to objects, others to actions. Still others are names,

attributes of objects, or traits of persons. The semantic category of a sign, then, specifies what type of sign this is in terms of its referential meaning: A sign can belong to the semantic category of object signs, or of action signs, or of name signs, and so on. The signs that the chimpanzees acquired could similarly be assigned to separate semantic categories.[59] This categorization was done not only by considering the gloss of the sign, but more than that, by carefully looking at the usage of the sign within its whole context.

For the Gardners' chimpanzees there are several sources of information concerning the particular acquired signs and their usage. For Washoe the usage of the signs in her vocabulary was presented each time a list of her vocabulary was published.[60] For the combined reliable vocabulary of all the Gardners' cross-fostered chimpanzees, one has to turn to Chapter 3 of the book that the Gardners and their co-worker Thomas Van Cantfort[61] published in 1989, *Teaching sign language to chimpanzees.* The chapter is called "The shapes and uses of signs in a cross-fostering laboratory" and is written by the Gardners together with Susan Nichols, who had been part of Project Washoe as a graduate student, right from its beginning. The major part of the chapter is a list of 220 different signs that had become part of the chimpanzees' combined reliable vocabularies while they were still with the Gardners.[62] This list, published as Table 3.2., only specifies the particular PCM of each sign, however, and not its usage. Information on the use of the signs is given in Table 3.1 of

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[59] In Part II of chapter 5, the Discussion chapter of this dissertation, the exact nature of the signs that the chimpanzees learned will be examined. It will be attempted to determine at what level of reference these signs should be considered to exist. The main question will be whether the chimpanzee signs should be interpreted as conditioned responses or whether they function as actual symbols that refer to things. Only in the latter case can one actually interpret the signs to carry meaning. For now, however, the division into semantic categories of the signs, in this and other sections, is applied as a working hypothesis. The researchers in the projects claim that these semantic categories are present. In the further discussion of their conclusions, as well as in the results of the new study undertaken by the author, the validity of these claims will be assessed.

[60] Washoe's developing vocabulary was published as an appendix to the Gardner's articles of 1969, 1971, 1972 and, lastly, 1975.

[61] Van Cantfort wrote his dissertation on the replies of the chimpanzees to human Wh-questions.

[62] This number was calculated by adding the signs in Table 3.2. Gardner, Gardner, and Nichols explained that the table contained 430 signs. They arrived at this number by including variants of the same glossed sign by the different cross-fosterlings.

Note that not all of the 220 signs were part of the individual vocabulary of each cross-fostered chimpanzee subject of the Gardners. Though many signs were learned by all chimpanzees, some signs were eventually acquired by only one or two chimpanzees. The total number of signs in the reliable vocabulary of each individual chimpanzee at the end of his or her time with the Gardners, is as follows. Washoe: 132. Moja: 168. Tatu: 140. Dar: 122 (Gardner et al., 1989).

the same chapter. Here the semantic categories are presented. For each separate semantic category a list of those signs assigned to that particular category is given, together with a short description of the usual contexts in which one of the signs in this category was used, "typical questions" that evoked this sign, as well as a few examples of phrases in which that sign was used by the chimpanzees.

The semantic categories used by the Gardners and Fouts included the terms noun, verb, noun/verb, and pronoun. However, these terms refer to grammatical or syntactic categories rather than semantic ones.[63] Using syntactic category terms suggests a mastery of a grammatical framework, where the apes have grasped the concept that some signs have their place as nouns, others as verbs and so on. The results of the projects, however, provide no evidence for such syntactic categories in the apes' sign use (see section 2.2.4.). More appropriate terms are therefore: object signs, action signs, object/action signs and person signs.[64] The author will use these latter terms throughout the text of this dissertation.

Each semantic category from the Gardner classification will now be presented. Inappropriate syntactic category terms are replaced by semantic ones. For each semantic category the number will be given of the signs within the chimpanzees' combined reliable vocabularies that were grouped in that category (based on Table 3.1 of Gardner, Gardner, and Nichols, 1989, and Table 1 of Gardner and Gardner, 1994a).

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[63] Terrace and his colleagues also sometimes used these terms to describe Nim's signs, but did not call them semantic categories. In 1980 they describe them as "lexical categories."

[64] The child language researcher Katherine Nelson (1973) confronted the problem of classifying the first 50 words of children when they were using little combinations of words that could demonstrate a grasp of grammatical relations and categories. Rather than using grammatical classes such as nouns and verbs, Nelson came up with the labels 'nominals' and 'action words.' Subsequently, the earliest words of children were grouped according to semantic rather than syntactic category (Clark, 1993). Braine (1976), however, mentions that almost all earlier child language studies used the noun and verb categories in order to have word-class categories at least, and because the empirical use of the words was often similar to the adult use of these categories. In their analysis of the bonobo Kanzi's lexigram use, Greenfield and Savage-Rumbaugh (1990), in contrast to the Gardners, are aware of the importance of making a clear distinction between semantic and syntactic categories.

In 1978 the Gardners make a remark that maybe shows their motive for using the syntactical categories noun and verb to describe the chimpanzees' signs. When they discuss the overgeneralization of the chimpanzees' first signs, they say the following: "For action signs, such as *cry, go,* or *up,* the course of generalization showed extensions beyond self-reference [which have not been published, *ER*], and thus, the development of an action sign into a verb" (p. 51). This sentence suggests that as soon as the chimpanzee uses a sign in reference to someone else, a syntactical category such as verb is justified. Such reasoning does not logically follow, though.

Objects.

Signs in this category were divided into three subcategories: Object signs that referred to edibles, to inanimate objects, or to animates.

Objects: Edibles.

Number of signs within this category: 29. Examples: APPLE, BANANA, COOKIE, GUM, SANDWICH, SODAPOP. The sign COFFEE is then further specified in Table 3.1, in that it was used for coffee or tea, in all kinds of cups and containers, as well as for pictures of cups of coffee. The sign appeared in response to human questions such as: WHAT THAT DRINK? or WHAT WANT? According to the Table it was used in combinations such as: COFFEE DRINK, THAT COFFEE, and BABY DRINK MORE COFFEE (in the context of caretaker Susan pretending to give coffee to a doll).

Objects: Inanimates.

Number of signs: 49. Examples: BALL, BOOK, CLOTHES, HAT, HURT, SHOE, TOOTHPASTE, TREE. WRISTWATCH is the example here. This sign was used for wristwatches and pictures of this object. It was produced in response to questions such as WHAT THAT? or NAME THAT, and made in combinations such as THAT WRISTWATCH, WRISTWATCH GIMME and WRISTWATCH BLACK.

Objects: Animates.

Number of signs: 9. Examples: BABY, BIRD, CAT, DOG. The sign BIRD is presented as example of this category. The sign was used for all kinds of birds, toy birds, pictures of birds, as well as bird calls and human renditions of bird calls. Human questions that evoked BIRD were: WHAT THAT? or WHO SAY "quack quack"(spoken animal call)? Combinations with BIRD were: THAT BIRD, RED BIRD and LISTEN BIRD.

Objects/Actions.

Number of signs in this category: 29. Examples: BRUSH, DRINK, FOOD/EAT, HEAR/LISTEN, PEEKABOO. The sign TOOTHBRUSH functions as example here. It is

used for toothbrushes, pictures of toothbrushes, but also for the action of brushing the teeth. Human questions evoking it: WHAT NOW? WHAT DO? Used in combinations such as: TIME TOOTHBRUSH, TOOTHBRUSH DAR.

Actions.

Number of signs: 18. Examples: BITE, CRY, GO, HUG, LAUGH, OPEN. As example, CHASE was used for chasing and being chased in play. Made in response to WHAT WANT? WHAT PLAY? Examples of combinations: TATU CHASE, YOU CHASE.

Names: Chimpanzees.

Number of signs: 4, which are: DAR, MOJA, TATU and WASHOE. Used in response to human questions such as WHO THAT? WHO YOU? WHAT YOUR NAME? or WHO CHASE? And for DAR as example, it was used in combinations such as: CHASE DAR, DRINK DAR, MILK DAR and GOOD DAR.

Names: Humans.

Number of signs: 31. Examples: NAOMI, SUSAN, R. A. GARDNER, ROGER. Contexts of use were the humans or pictures of these humans. These signs could be evoked by WHO THAT? WHO ME? or WHO TICKLE NOW? Combinations with NAOMI could be: YOU NAOMI, NAOMI TICKLE, NAOMI GOOD.

Names: Generic.

There were 3 signs in this category: BOY, FRIEND and GIRL. BOY was used for "males, especially male strangers or familiar males who do not have name signs; pictures of men in magazines" (p. 66). Questions that the sign was made in response to were: WHO THAT? WHICH-SEX THAT? WHICH-SEX YOU? Combinations: THAT BOY, GOOD DAR BOY, R.A.G. [R.A. Gardner] BOY.

Person terms.

Three signs in this category: ME, WE (only acquired by Washoe) and YOU. YOU is further specified: used for "the addressee during food-sharing, games with turns such as tickle and

hide and other activities" (p. 67). In response to: WHO TICKLE? WHO EAT?, in combinations such as: YOU JIM, YOU PEEKABOO and YOU TICKLE ME WASHOE.

Locatives.

The following six signs: DOWN, HOME, IN/ENTER, OUT, THERE and UP. The context description of OUT is: "requesting change in location, as going outdoors or removing an object from a container; designation of location of a person or an object" (p. 69). Human questions that evoked OUT: WHERE GO? WHERE DAR? WHAT WE DO? Produced by the chimpanzees in combinations such as: YOU ME OUT, PLEASE BLANKET OUT (in the context of a blanket in a cupboard) , and OUT HOME MILK DAR (when they were in the playroom).

Demonstratives.

There was one sign in this category: THAT. This sign indicated objects that were present.[65]

Attributes: Colours.

The five following signs: BLACK, GREEN (Washoe only), ORANGE, RED and WHITE. As example BLACK is described. This sign was used for "purse, dog, shoe and other items that are black; indicating the part of a multicoloured item that is black" (p. 70). Human questions: WHAT COLOR THAT? WHAT COLOR HAT? Chimpanzee combinations: THAT BLACK, SHOE BLACK.

Attributes: Possessives.

Two signs: MINE and YOURS. As example, YOURS was used for objects that belonged to the companion of the chimpanzee. Questions this sign was used in response to: WHOSE THAT? WHOSE SHOE? Combinations: HAT YOURS, CANDY YOURS, SUSAN YOURS.

Attributes: Materials.

Three signs: GLASS, METAL and WOOD. For example, METAL was used for pans, spoons and other items made of metal. Made in response to: WHAT THAT MAKE FROM? In combinations such as: THAT METAL, METAL HOT.

Attributes: Quantitatives.

Two signs in this category: ONE (acquired by Moja and Tatu) and TWO (acquired by Moja only). As example, ONE was used "when single items such as a nut, a match, a glove are displayed" (p. 71). In response to: HOW MANY? HOW MANY CANDY? HOW MANY GRAPE WANT EAT? Used in combinations such as: ONE BLACK, ONE NUT and ONE GUM.

Attributes: Comparatives.

Four signs were acquired in this category, two by Washoe: DIFFERENT and SAME, and two by Moja: BIG and SMALL. BIG is then discussed further. It was made "when pairs of items that differ in size are displayed such as balls, spoons or toy animals" (p. 71). Made in response to: WHAT SIZE THAT? THIS SMALL HORSE, WHAT THAT? Combinations with this sign were: BIG BALL, BIG HORSE and BIG SPOON.

Attributes: Qualities.

Three signs: HOT, SOUR (Tatu only) and SWEET. For example, HOT was used for substances that are hot (water, soup, meat) as well as sources of heat (stoves or furnaces). Human questions to evoke this sign: WHAT TEMPERATURE THAT? Combinations made with HOT: THAT HOT, HOT WATER, SANDWICH HOT.

Markers and traits.

Number of signs: 20. This is a special category in which each sign was individually discussed by the Gardners, because their usage was considered to be "both more complex and significant" (p. 65). Not every individual sign in this category will be reproduced here, but a

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[65] This category was not part of the semantic category division as presented in Table 3.1 of Gardner, Gardner, and Nichols (1989). However, in Table 1 of Gardner and Gardner (1994a) they have added this category to their

further division is made by the author into request markers, traits, negatives, question signs, and a rest category called "other."

Request markers.

Included are the following signs: AGAIN (acquired only by Moja), COME/GIMME, HURRY, MORE, PLEASE. The context in which these signs were used, specified for each individual sign: AGAIN: requesting continuation of some activity. COME/GIMME: requesting someone to approach or provide an object. HURRY: requesting to do things quickly. MORE: requesting continuation and repetition of activities, or additional helpings of edibles. And PLEASE: requesting objects and activities. Questions that evoked request markers: WHAT WANT? WHAT NOW? WHAT DO? or ASK POLITE (to evoke the sign PLEASE). Combinations with these request markers: AGAIN TICKLE, COME HUG, GIMME MILK, OPEN HURRY, MORE SODAPOP DAR, PLEASE FLOWER.

Traits.

Included are three signs: FUNNY, GOOD, and SORRY.

The use of FUNNY, only acquired by Washoe, is given as "an epithet, usually for oneself; during tickling, chasing and other playful interaction; occasionally, when being pursued after mischief" (p. 73). The only example in Table 3.1 of a human question that evoked FUNNY, however, is not very useful. It is WHO FUNNY? to which a response with FUNNY by the chimpanzee would amount to imitation. Combinations that were recorded: FUNNY ME, FUNNY WASHOE, TICKLE FUNNY, and FUNNY SUSAN FUNNY.

GOOD also was used as an epithet, and again usually for the chimpanzee him- or herself. Further description: "part of requests, especially for eyeglasses, watch or other breakable belongings of companion; part of apologies and appeasement after mischief; could also be understood as a promise to 'be good' " (p. 74). It was produced after human utterances such as YOU BAD GIRL and NO CAN'T GO THERE. Combinations were: GOOD ME, GOOD MOJA, SORRY GOOD, and TATU GOOD OUT GO.

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list of semantic categories. Before this publication THAT had already been described as a demonstrative.

SORRY was used as an epithet for oneself and could be "part of apology and appeasement after an escape, a toilet accident, breaking something, and other offenses" (p. 76). In response to typical human utterances such as: YOU GOOD NOW? ASK PARDON, and YOU POTTY THERE, BAD. Combined as in: SORRY GOOD, ME SORRY, WASHOE SORRY, COME HUG SORRY.

Negatives.

Four signs were categorized as negatives or negative markers: CAN'T, ENOUGH, FINISH, and NO.

- *CAN'T.* Context: "unable to do a task, as after many attempts to unlock a door, open a jar, break a stick; unable to answer a question; often used in toilet situations; could also be understood as a refusal" (p. 72). Human questions evoking it: CAN YOU POTTY MORE?, YOU TRY POTTY, CAN YOU BREAK THAT? Chimpanzee combinations: DIRTY CAN'T, POTTY CAN'T, OUT OPEN CAN'T.

- *ENOUGH.* Context: "ending routine activities such as a meal, a bath, a lesson. Made in response to questions such as YOU FINISH? Used in combinations such as ENOUGH FOOD, ENOUGH SWALLOW ENOUGH, and OUT ENOUGH TOOTHBRUSH (at the end of supper).

- *FINISH.* Context: "ending routine activities, such as a meal, a toilet session, a bath. In response to human questions such as: WHAT NOW? MORE EAT? MORE CLEAN? Made in combinations such as SCHOOL FINISH, FINISH POTTY, and FINISH HURRY.

- *NO.* Context: "negation; used in reply to commands, questions, and statements; also, in response to actions such as a stranger's offer to pick up subject, threats to throw snowballs or splash water at the subject, and occasionally, offers of food" (p. 76). In response to: YOU WANT SHOE THERE? WANT GO HOME? ME EAT THAT? COME, TIME SLEEP. Made in combinations such as: BATH NO, BED NO and HOT NO (after unplugging a heater).

Question signs.

Two question signs were acquired: WHAT, by Moja only, and WHO, by Washoe and Tatu. The context of the use of WHAT is described as: "interesting out-of-view objects, such as contents of backpacks, pockets, clasped hands; pictures or objects for which the sign is unknown to subject; could be understood as question" (p. 78). It is mentioned that it could be evoked after the human signing ASK, but was usually self-initiated. Used in combinations such as: WHAT THAT? PLEASE WHAT SEE EAT (at a closed refrigerator).

WHO was used for "persons or their pictures, and subject's mirror image; could be understood as question" (p. 78). This sign too was usually self-initiated. It was produced in combinations such as WHO THAT? and WHO YOU?

Other.

Signs in this remaining category, presented here in detail:

- *YES.* This sign was only acquired by Moja. Context: "agreement; used in reply to questions offering objects or activities" (p. 79). In response to: YOU WANT THAT? WANT MORE? Made in combinations such as MILK YES and OUT YES.
- *TIME.* Context: "announcing or requesting the next event of the daily routine and other imminent events" (p. 77). In response to: WHAT NOW? Produced in combinations such as: TIME EAT, TIME TOOTHBRUSH and TIME DAR OUT.

Further "Other" signs not represented here in detail were: DIRTY, GOODBYE, HELP, WANT.

Similarities with human children's early vocabulary.

The Gardners used the chimpanzees' vocabulary lists and the semantic categorization of their signs for a comparison with the early vocabulary of human children. They concluded that one of the basic similarities that exists between the chimpanzees' sign use and the language of young human children is the similarity in content of both the chimpanzees' and the human

children's early vocabulary (Gardner & Gardner, 1975a, 1978, 1980, 1994b). The chimpanzees' first 50 signs were compared to the first 50 words that the linguist Katherine Nelson (1973) found to occur in children. Based on conceptual content, Nelson had grouped together the first 50 words of 18 English-speaking children's earliest utterances. These children were studied from about one year old up till their 25th month of age. She found the existence of the following categories in all of these children (with examples):

- General Nominals: *doggie, ball, milk*, also including pronouns such as *he*, and *that.*
- Specific Nominals: *Mommy, Daddy, Dizzy* (name of pet).
- Action Words: *go, out, up, look.*
- Modifiers: attributes: *big, red*; states: *hot, all gone*; locatives: *there, outside*; possessives: *mine.*
- Personal-Social words: *no, want, thank you, please.*
- Function words: *What, Where, is, to, for.*[66]

The Gardners found all of these categories to exist among the semantic categories of the chimpanzees' first signs. Also, there was a similarity between the ape and child vocabularies in the number of words or signs within each of these categories. Thus, in both species the General Nominals accounted for about half of all lexical items.

The Gardners (1994b) further compared the first 50 signs of a deaf child from a 1975 study by Collins-Ahlgren to Nelson's children and this also resulted in an important agreement.[67] The Gardners calculated that the signing children had a median of 32 matching items, which is comparable to the median of 29.5 among Nelson's speaking children (as further determined by the Gardners). The number of matching items or overlap with the

[66] Nelson's study has since been replicated by other researchers, who obtained similar findings on the contents of children's early vocabulary. Cross-linguistic research has shown a similar content of the early lexicon in many different languages, especially a predominance of object words (Dromi, 1999).

[67] Bonvillian (1999) mentions other studies that showed a similar content of the early lexicon of both sign and spoken languages, both in the different semantic categories as well as the number of lexical items within those categories. Even the specific lexical items are similar. The early lexicons are called "nearly identical." One exception was found though. This was a very low incidence of signs that are the equivalent of function words (only 1%). This difference can be accounted for by the fact that in ASL such function words are incorporated into the sign utterances in other ways.

speaking children was then calculated for each of their cross-fostered chimpanzees' first 50 reliable signs. Washoe's overlap had a median of 31.5 items, Moja 28.5, Pili 30.5, and Tatu and Dar both 29.0.

The Gardners (1978) call the similarities in content between the early vocabulary of child and chimpanzee "the most striking parallelism" (p. 50) between the early sign use of the chimpanzees and the early speech or signing of children.[68] Seidenberg & Petitto (1987), however, stress that closer comparisons between the vocabularies are still necessary, especially in terms of composition, order of acquisition and frequency of use.

Terrace's description of Nim's vocabulary.

Herbert Terrace presents in Appendix C of his book *Nim* what he calls the "expressive vocabulary" of Nim. It consists of the 125 signs that Nim had acquired by the end of Project Nim. This appendix is comparable to Tables 3.1 and 3.2 in the Gardner et al. (1989) chapter on the Reno chimpanzees' signs. For each sign of Nim the acquisition date is given, its usage is briefly described, and, comparable to the Gardners' PCM description of the sign, the Location (L), the Configuration and orientation of active hand(s) (C), and the Movement (M) involved in the sign, are given.

Terrace did not explicitly classify all of these signs into separate semantic categories. However, based on the description of the signs' usage, an attempt can be made to assign Nim's 125 signs to the semantic categories just presented for the Gardners' chimpanzees. This will allow for comparisons between the different chimpanzees. This categorization of Nim's signs is presented in full detail here, so readers can transparently see to which category each sign was assigned by the author.

Objects: Animates.

Number of signs: 5. BIRD, BUG, CAT, DOG, FISH.

Objects: Edibles.

Number of signs: 19. APPLE, BANANA, BERRY, COOKIE, CRACKER, DRINK, EAT, FRUIT, GRAPE, GUM, ICE, NUT, ORANGE[69], PEACH, PEAR, RAISIN, TEA, WATER, YOGURT.

Objects: Inanimates.

Number of signs: 35. BABY, BALL, BALLOON, BOOK, BOWL, BOX, CHAIR, CUP, EAR, EYE, FLOWER, GLASSES, HAND CREAM, HARMONICA, HAT, HOUSE, KEY, LIGHT, LISTEN, MUSIC, NAPKINS, NOSE, PANTS, PAPER, POLE, POOL, POWDER, ROCK, SHIRT, SHOE, SMELL, SPOON, TEETH, TREE, WAGON.

Objects/Actions.

Number of signs: 3. BRUSH, DIRTY, TOOTHBRUSH.

Actions.

Number of signs: 20. BITE, CLEAN, CLIMB, CUT, GO, GROOM, HUG, JUMP, KISS, LIE DOWN, OPEN, PLAY, PULL, RUN, SLEEP, THROW, TICKLE, WALK, WASH, WORK.

Names: Chimpanzees.

One sign: NIM (no other chimpanzees were present).

Names, humans.

Number of signs: 12. ANDREA, BILL, BOB, DICK, HERB, JOYCE, LAURA, MARY, RENEE, STEVE, SUSAN, WALTER.

Names, generic.

None.

Person terms.

Two signs: ME, YOU.

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[68] A similar conclusion is drawn by Bonvillian (1999) concerning spoken and sign languages: "the resemblance in the lexicons between the children learning to sign and their speaking counterparts was quite striking" (p. 286).

[69] This sign was counted twice by the author, as a noun for an edible and as a colour, because the description of its usage makes it clear that Nim used it as such. It compares to the way the Gardners' chimpanzees used ORANGE in both categories.

Locatives.

Five signs: DOWN, IN, OUT, POINT, UP.

Modifiers: Colours.

Six signs: BLACK, BLUE, BROWN, GREEN, ORANGE, RED.

Modifiers: Possessives. None.

Modifiers: Materials. None.

Modifiers: Quantitatives. None.

Modifiers: Comparatives. None.

Modifiers: Qualities.

Two signs: HOT, SWEET

HOT: "in the presence of heat from a specific source (floodlights for filming, hotplate, flames, hot water, tea)" (p. 274).

SWEET: "to request or identify "sweet-tasting" items (candy, honey)."

Markers and traits. Number of signs: 11.

Request markers.

COME, GIVE, HURRY, MORE, PLEASE. The following two signs may be interpreted as further request markers:

- HUNGRY. "Usually when he has not eaten recently; food may or may not be present" (p. 280).

- THIRSTY. "to request a drink, which may or may not be present" (p. 284).

Traits.

- ANGRY. "In stressful situations when prior requests have been denied by companion, who often is angry at him" (p. 280).

- BAD. "After a teacher has scolded him for misbehaving, to acknowledge that he has misbehaved" (p. 282).

- HAPPY. "When excited, as in tickle game" (p. 278).

- SORRY. Usage: "after Nim has done something for which he is being or usually will be reprimanded; when companion is emotionally upset, not necessarily because of Nim" (p. 272).[70]

Question signs. None.[71]

Other.

HURT. Its usage is partly an object sign for an injury (e.g. scratch) on himself or a companion, but it is also used "when he hurt himself (by falling and bumping his head)" (p. 268). Remaining signs: FINISH, GOODBYE, HELLO, HELP.

All signing chimpanzees, then, passed the different reliability or acquisition criteria for signs in the following semantic categories: object signs for edibles, animates, and inanimate objects; actions; objects/actions; names for chimpanzees and humans; general person terms (YOU and ME); location terms; colour terms; terms for qualities; request markers; traits; and

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[70] Terrace (1979a) describes that the use of this sign did not necessarily indicate that Nim was truly feeling sorry:

> A more effective technique of disciplining him was to walk away, preferably while signing something like YOU BAD or I NOT LOVE YOU. Instantly he would stop what he was doing and run toward his teacher, often signing SORRY, HUG, or both. For many months this procedure sufficed. But as Nim got older and more independent, the SORRY-HUG routine became more of a game than an expression of true remorse. Too often his behavior was just as mischievous after he signed SORRY and HUG as before. (p. 72)

Such "manipulative" use of SORRY has also been informally reported for the chimpanzees at the CHCI, especially for Tatu. Both SORRY and HUG may well be made without any reference to an internal state, because they can both be used as effective requests for reassurance from the humans when the apes have done something wrong (Terrace and Bever, 1976). Seidenberg & Petitto (1979) further say that with Nim "this gesture was largely under the control of his teachers' threats. If they appeared angry or ready to punish him, he would sign *sorry*. This sign appeared almost exclusively in contexts where such a threat was imminent" (p. 193). Their conclusion on whether Nim (or the other apes) understood the sign as an expression of remorse is that

> rather, in signing *sorry*, the apes appear to have learned about the pragmatics of language use. Nim knew that by signing *sorry* in certain contexts, he could affect his teachers' behaviors in ways beneficial to him. He learned the consequences of the act of signing *sorry* rather than its meaning and grammatical function. (p. 194)

[71] Terrace, Petitto, Sanders, and Bever (1980, p. 379) add that Nim had originally acquired two further signs that were, however, later deleted from his vocabulary because he did not appear to understand their actual meaning and only used them in a routine fashion. Significantly, these signs were TIME and WHAT. Analyzing the occurrence of these signs in their records, they found that these served more as routine event markers. They never appeared except in combination with another sign and were always in first position. In fact, the Gardners (1975b) actually have data about Washoe's use of TIME that corresponds closely with that of Nim. The result of the Wh-question test showed that 42 out of the 43 times that she replied with TIME, the sign occurred in combination with an action sign. Indeed, they say that "this is typical of Washoe's use of the sign *time* in our other records suggesting that it was a modifier of action signs rather than an independent sign form" (p. 254). Terrace et al. (1980) say that there is no evidence that Washoe understood the meaning of TIME, but that she seemed to have learned it as an appropriate response when requesting something.

a rest category of "other" terms. Differences between Nim's vocabulary and that of the Gardners' chimpanzees can be found in the total absence in the former of signs for generic names, possessives, materials, quantitatives, comparatives, and question signs.

1.4. Methods of classification.

The Gardners' assignment of the chimpanzees' signs into semantic categories was based on the use of these signs by the chimpanzees. The data on this usage were derived from the field records, where a context description was given when a sign was entered. For each reliable sign, at least eighteen observations existed in these records. First, three observations by which the sign became an officially observed sign. And later, one observation on each of 15 consecutive days, by which the sign fulfilled the criterion of a reliable sign. Additional observations came from the Sign Of the Day (SOD) procedure, described shortly, in which each sign was reassessed by evoking it within obligatory contexts every three months. With this reassessment procedure, care was taken to describe the sign's use in as much detail as in the criterial observations records. The following methods were the classification procedures used by the Gardners to determine the nature of a sign. They were the method of using obligatory contexts, and the varieties of this procedure in the analyses of responses to Wh-questions, and the application of object sign vocabulary tests.

1.4.1. Obligatory contexts. Most observations of signs were gathered in what were called "obligatory contexts" (Gardner & Gardner, 1980, 1984, 1989). In the obligatory contexts, the situation and context were controlled in such a way that when the chimpanzee was asked a particular question, only one answer could be correct (hence the term *obligatory*). If the chimpanzee gave the correct answer, then the reasoning was that this showed that the chimpanzee had grasped the meaning of that particular sign. In effect, the evoking of signs in these controlled conditions was the main method by which they assessed the meaning or semantic category of the signs. To give an example of this procedure, to

assess the chimpanzees' grasp of object signs, an object or picture was shown to the chimpanzees and a question was asked such as WHAT THAT? or WHAT NAME THAT? The chimpanzees then had to give the only contextually correct object sign. Name signs were checked by showing a picture of a person and then asking WHO THAT? Colour signs similarly were assessed by asking WHAT COLOR THAT?[72] The 18 criterial observations necessary for a sign to become reliable, could all be evoked by making use of these obligatory contexts for the specific target sign in question.

Though further examples of other questions in obligatory contexts are not explicitly presented, Table 3.1 of 1989 gives examples of the use of the different semantic categories in response to questions, represented here in Table 2.1. These questions are probably the questions that were also asked to assess their meaning in the obligatory contexts. Thus, it appears that action signs were elicited by asking WHAT DO? Locatives by asking questions such as WHERE THAT?, or WHERE GO? Possessives were evoked by presenting them questions such as WHOSE THAT? And signs for materials by asking WHAT THAT MAKE FROM? Apparently, according to the Gardners, the chimpanzees could all understand these particular questions. Their claim is that the chimpanzees even signed BOY or GIRL when asked WHICH SEX THAT?; ONE or TWO when asked HOW MANY?; BIG or SMALL when asked WHAT SIZE THAT?; and HOT when asked WHAT TEMPERATURE THAT?[73]

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[72] Gardner et al. (1989) say that for some of the signs a lot of ingenuity was needed to create the appropriate obligatory contexts. The sign NO (made by shaking the head from side to side) is then discussed for Washoe. It is said that they had "great difficulty" in evoking NO from Washoe by asking her unreasonable demands, such as ordering her to bed in the afternoon or giving her something inedible to eat. Washoe would then evade these situations and did not sign NO in response. In 1974a the Gardners say that evoking the informative use of NO by asking her questions such as IS THIS BLACK? for a red object, or IS THIS A DOG? for a tree, "would have been confusing" (p. 20). They then say that they eventually struck on the idea of telling her a variety of tales and stories. These finally evoked the sign. In a typical example of such a story (described in detail on page 20 of 1974a), Roger Fouts says to Washoe: "Washoe, there is a big black dog outside - with big teeth. It is a dog that eats little chimps. You want to go out now?" Washoe responded with a prolonged and emphatic NO.

[73] The Gardners (1980) claim that the chimpanzees could also understand the causal question WHAT FOR THAT? They describe how Moja "was replying ... with action signs, when asked causal questions, *What for that?* of an object. Thus, a *nut* she had requested was for *eat*, a whistle was for *blow*, and the shoes and hat the questioner indicated were for *Go out*" (p. 350).

The Sign Of the Day procedure is another form of using obligatory contexts to evoke signs from the chimpanzees. In this procedure all humans working with the chimpanzees had to attempt to elicit one particular sign on a day, the Sign of that Day. The humans could show the chimpanzee the particular object that was the referent of the SOD. Or they could set up the context so as to result in a situation where the appointed sign was probable to occur (Gardner & Gardner, 1978).

The appropriate responses by the chimpanzees in the obligatory contexts is considered to be "most of the hard evidence" (Gardner et al. 1989, p. 63) for the appropriate usage of the signs. That is, in comparison with the chimpanzees' appropriate use of the signs in spontaneous utterances. Indeed, the Gardners say that adventitious observations of spontaneous use of signs remained doubtful until they were corroborated by correct and appropriate responses to specific questions put to the chimpanzees in the obligatory contexts. Therefore "so much of the evidence [regarding the appropriate usage, or in other words, the meaning, of individual signs, *ER*] must be based on answers to specific questions" (p. 64).

1.4.2. Wh-questions studies. Another form of asking questions in obligatory contexts are the Wh-questions studies. In the analyses of the chimpanzees' replies to these questions, the Gardners had set out in advance the correct semantic target category that belonged to the different kinds of Wh-question (as will be described below). The results were used to add proof to the claim that the signs of the chimpanzees belonged to separate, solid categories of semantic meaning. Because these studies are an important part of the Gardners' work they will be discussed now in some detail.

Wh-questions are questions that include interrogatives such as Who, What, and Where (because in English they all start with a "wh" they are called Wh-questions). When a Wh-question is asked, not all answers are appropriate. Each specific Wh-question asks for a response from usually only one particular semantic category. Thus, questions with "Who" ask for a reply in the form of a proper name or a pronoun such as "me," "you," or "we." A

question with "Where" is usually intended to obtain a response that specifies a location. The Gardners thus specified for each particular Wh-question which semantic category was the appropriate response, calling this the target category. They then set out analyzing samples of the chimpanzee responses to human Wh-questions and calculated percentages of appropriate replies with the specified target category. The Gardners carried out several analyses in which they examined samples of the chimpanzees' replies to different kinds of Wh-questions (Gardner & Gardner, 1974a, 1975, 1978; Gardner, Van Cantfort, & Gardner, 1992; Van Cantfort, Gardner & Gardner, 1989).

Samples of replies were collected by documenting responses to Wh-questions that the chimpanzee's human companion asked during the normal course of the day. One sample of Washoe was collected during the 50th and 51st month of Project Washoe. In a period of several weeks, a total of 500 questions were put to Washoe, consisting of 10 different kinds of Wh-questions, which were each asked 50 times. These different questions, together with their target semantic category and examples, are presented in Table 2.1.

The four chimpanzees of the Gardners' second project, Moja, Pili, Tatu and Dar, were also presented with different questions in daily interactions. With these chimpanzees the Gardners systematically gathered a longitudinal series of samples of responses, collecting data at certain intervals over a period of several years. The collection of samples began when the chimpanzee subjects were 18 to 20 months old. This therefore started in 1975 with Moja and Pili. In subsequent years samples for Tatu and Dar were added. Data collection ended in 1981. Altogether 1,297 replies were gathered (for the exact number of the particular questions that were asked of each different chimpanzee individual, see Table 5.2 in Van Cantfort et al., 1989).

Table 2.1. Wh-questions and target semantic categories used with Washoe.

Wh-question type	Examples	Target semantic category	Examples
WHO+pronoun	WHO YOU? WHO ME?	Name	ME WASHOE. LINN. ROGER.
WHO+action	WHO SMOKE? WHO GO OUT?	Name or Person sign	YOU SMOKE. YOU ME.
WHO+trait	WHO GOOD? WHO PRETTY?	Name or Person sign	GOOD ME. WASHOE.
WHOSE+demonstrative	WHOSE THAT? WHOSE THOSE?	Possessive	MINE. SHOES YOURS.
WHAT COLOR?		Colour sign	BIRD WHITE. GREEN.
WHAT THAT?		Object	BOOK. FOOD FRUIT.
WHAT NOW?		Action	TICKLE. TIME DRINK.
WHAT WANT?		Object or Action	WANT BERRY. YOU ME OUT.
WHERE+action	WHERE WE GO? WHERE SHALL SUSAN PLAYBITE YOU?	Locative	OUT. SUSAN BITE THERE.
WHERE+object	WHERE SHOE? WHERE BABY?	Locative	THERE SHOE.

(Based on Table 1 in Gardner & Gardner, 1975). The examples of responses are actual responses that Washoe gave.

The exact question frames were similar to the ten given for Washoe, with the following few differences. WHO+pronoun was renamed WHO+demonstrative. There was now also a division into WHO+subject and WHO+object questions. WHAT COLOR generalized into WHAT+quality. Lastly, three new questions were analyzed that were not part of the Washoe analysis. These were: WHAT+object of action, WHAT+predicate, and HOW MANY? The next Table then lists the question frames used with Moja, Pili, Tatu and Dar, with examples of questions and chimpanzee replies.

Table 2.2. Wh-questions and target semantic categories used with Moja, Pili, Tatu and Dar.

Wh-question type	Examples	Target semantic category	Examples
WHO+demonstrative	FIRST WHO ME? WHAT YOUR NAME?	Name	TIM D. ME TATU.
WHO+subject	WHO TICKLE? WHO CHASE YOU?	Name or Person sign	YOU TICKLE. CLAYTON.
WHO+object	WHO ME CHASE? WHO RON TICKLE?	Name or Person sign	CHASE CHASE MOJA. RON ME
WHO+trait	WHO GOOD GIRL?	Name or Person sign	B. GARDNER.
WHO+possessive	WHOSE THAT? WHOSE BABY THAT? WHOSE WRISTWATCH THAT?	Possessive	MY BABY. YOURS. MINE...GIMME.
WHAT+quality	WHAT MAKE THAT? WHAT COLOR SHOE? WHAT COLOR GLOVE? WHAT COLOR THAT? WHAT CUP MAKE FROM?	Attribute	METAL. SHOE BLACK. BLACK BLACK. RED THAT. GLASS THAT.
WHAT+demonstrative	WHAT THIS? WHAT NAME THAT?	Object	LIGHT. NUT. BALL. THAT FLOWER.
WHAT WANT	WHAT YOU WANT?	Object or Action	EAT GUM. CHASE.
WHERE+action	WHERE YOU WANT GO? WHERE GROOM? TICKLE WHERE?	Locative	HOME. GROOM THERE. THERE.
WHERE+nominal	WHERE YOUR BLANKET? WHERE TOOTHBRUSH?	Locative	BLANKET THERE. OUT.
WHAT+object of action	TATU DRINK WHAT? WHAT ME SWALLOW?	Object	MILK. NUT SWALLOW.
WHAT+predicate	WHAT ME DO? WHAT WE PLAY?	Action	LAUGH. TICKLE THERE.
HOW MANY (Moja only)	HOW MANY? HOW MANY COWS?	Quantitative	TWO. ONE.

(Based on Gardner & Gardner, 1978; Gardner et al., 1992; Van Cantfort et al., 1989).

The results showed that for each particular question the chimpanzees responded above chance level with the appropriate semantic category. In Washoe's test, she responded with the correct semantic category to 84% of all the Wh-questions. The overall percentage of appropriate replies to all Wh-questions combined for Moja, Pili, Tatu, and Dar, ranged from 40% in the beginning to a high of 71% in the later samples. The Gardners therefore concluded that the Wh-question words exerted a high degree of control over the chimpanzees' responses. Their success in responding with the correct semantic category was interpreted to demonstrate a form of grammatical competence in the chimpanzees. This is because the appropriate semantic categories that are evoked by the Wh-questions can be seen as sentence constituents. The Wh-word acts as a "dummy element" that asks for specification by a category which then corresponds to an unfilled constituent of the sentence (Gardner & Gardner, 1975). Thus, the WHO in a WHO THAT? question asks for names as sentence constituent. Correct replies to Wh-questions in children are seen as evidence that they categorize words as "constituents of sentences, such as agents, actions, and objects of actions" (Van Cantfort et al., 1989, p. 237). The results of the Gardners' tests should therefore confer the same ability to the signing chimpanzees. Indeed, comparing Washoe's results with those of human children at Brown's Stage III,[74] the Gardners considered her replies to be superior to those of the children. The latter responded correctly to Wh-questions only about half the time, which is less than the 84 % reported for Washoe. The Gardners (1975) claimed that "if Washoe had been a preschool child, then by these standards her replies to the Wh questions of this sample would place her at a relatively advanced level of linguistic competence" (p. 255). In a comparison of the other four cross-fostered chimpanzees with human children, they found a similarity in the sense that in children too, the percentage of appropriate replies to Wh-questions increases with age (Gardner et al., 1992; Van Cantfort et al., 1989). Also, a similar developmental pattern could be discerned:

[74] The psycholinguist Roger Brown divided the language development of children into different stages. These are not solid, natural stages of development in the child, but a convenient way in which to segment children's

> The developmental sequence for different kinds of Wh-questions was also roughly parallel. Both children and chimpanzees initially provide nominals for What questions and locatives for Where questions, followed by verbs for What-do/predicate questions and proper nouns and pronouns for Who questions, followed still later by appropriate replies to How questions. (1992, p. 38)

1.4.3. Object signs vocabulary tests. The object sign tests that the Gardners administered to the cross-fosterlings are again other examples of using specific questions in obligatory contexts. They will be described in detail now. In these tests the chimpanzees were presented with objects or pictures of objects. They were then asked to name the object or picture by producing the correct sign for it (Gardner & Gardner, 1971, 1974, 1978, 1984, 1985, 1989b, 1989c). At first the Gardners used different designs of the test with Washoe, to eventually settle on a slide test as the most convenient procedure to use. In the first test with Washoe, called the card test, cards with colour pictures on them were held up to the chimpanzee. In a later version, the box test, pictures or the objects themselves were put in a plywood box with a plexiglass window on one side. Eventually they reverted to slides of objects that were projected onto a screen. This slide test was administered to four chimpanzees. First with Washoe, and later with Moja, Tatu, Dar.

The major objective of these tests was to demonstrate that the chimpanzees were able to use signs to transmit information to a human interlocutor. That is, information that the human had no knowledge of. The tests were administered under double-blind conditions. The human interacting with the chimpanzee had therefore no knowledge of the objects or pictures that were shown, as these were out of the visible field of this human. This was insured in different ways. In the card test with Washoe the cards had been laid face down by another experimenter in a cupboard, and Washoe's human companion showed them to her without

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linguistic progress and a useful division for investigational analysis (Bowerman, 1973a; Brown, 1973).

watching the front side of the cards. In the box test, the box itself ensured that the human could not see what was inside. Only the chimpanzee was shown the window side, while the human could only see the opaque plywood sides of the box. The design of the slide test, lastly, was such that the projection screen of the slide apparatus was only visible to the chimpanzee and a human behind a one-way screen, but not to the human interlocutor. Furthermore, in all varieties of the tests, the pictures or objects had been arranged before by a human other than the interlocutor. Thus, in all of these tests cues from the humans were prevented. There could be no interference by what has been called the Clever Hans effect.[75]

In all three varieties of tests, an object item was represented by several different exemplars. Most of these were new pictures or objects that had not been seen before by the chimpanzees. Some objects and pictures in the box test were familiar to Washoe. In the slide test, however, each slide showed a novel picture

> because the chimpanzee subject had never seen that object before or because it was the first time that the subject had ever seen a photograph of that particular object or because it was the first time that the subject had ever seen that particular photograph of that particular object. (Gardner & Gardner, 1984, p. 388)

In Washoe's card and box test each object item was represented by three different exemplars. In the card test ten object items were tested. The total number of items used in the box test

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[75] In the beginning of the 20th century the horse Kluger Hans in Berlin, Germany, had become famous for being able to tap out with his hoof or by moving and shaking his head up or down, left or right, certain mathematic and intelligent questions. He could count, multiply, divide, solve problems in arithmetic and even read German, tell the time, and more such fantastic feats (Chevalier-Skolnikoff, 1981; De Luce & Wilder, 1983; Hediger, 1981; Lieberman, 1984; Sebeok, 1980; Sebeok & Rosenthal, 1981 Stokoe, 1983). On closer examination, the experimental psychologist Oskar Pfungst found out that the horse was unintentionally cued by the people who questioned him, such as his owner Wilhelm von Osten. These cues involved changes in posture and inclination of the head, the raising of the eyebrows and dilation of the nostrils. Certain motions of expectancy indicated Hans to start tapping, while motions of relief or satisfaction when the questioner thought he had tapped a correct number of times, cued Hans to stop tapping at the right moment. Movements of the human questioner's head were the cues for Hans to move or shake his head in the appropriate way. The horse was rewarded for a correct performance with bread and carrots. Since this demasking of intelligent and mathematical abilities of a horse, the cueing by humans to produce the correct behaviour in nonhuman animals, has been called the Clever Hans effect or Clever Hans phenomenon. Several scholars have mentioned the role of the Clever Hans effect in their explanation of the signing behaviour of apes (Dawkins, 1993; M. Gardner, 1981; Hediger, 1981; Sebeok, 1980; Sebeok & Rosenthal, 1981; Umiker-Sebeok & Sebeok, 1980; Wade, 1980).

does not get reported, though sessions are mentioned where 33 items were used. In the slide test each object item was presented by four different exemplars. The target object signs of the tests were already in the vocabulary of the chimpanzees. The object items that were tested for each individual chimpanzee sometimes varied, because not all chimpanzees had the same object signs in their vocabulary. Each chimpanzee got presented with a number of items ranging from 16 to 35 items. A total of 56 different object items were thus tested in all the chimpanzee subjects' tests combined.

The object items presented were divided into the following categories by the Gardners (here presented in order of magnitude): "Foods" (19 items), such as apple, cheese and nut; "Other" (9 items), such as ball, car, and key; "Animates" (7), such as bird, cat and dog; "Grooming" (7), such as brush, oil and toothbrush; "Drinks" (4), such as coffee and sodapop; "Clothing" (4), such as hat and shoe; "Plants," with three items: flower, leaf and tree. Finally, three items were grouped by the Gardners into what they called "Sensory." Only the signs of this category are mentioned, though, without the corresponding objects. They were LISTENS, LOOKS and SMELLS. From the Gardners' other publications one can infer that the LISTENS were watches, clocks and other sound producing objects (radios, bells, etc.). The LOOKS were optical devices such as (sun)glasses, binoculars and magnifying lenses. SMELLS consisted of scented objects such as tobacco, sage or perfume bottles.

The Gardners eventually called all of these tests "vocabulary tests." However, as can be seen from the description of the tests, only (pictures of) objects were tested. No other semantic categories were tested. No action signs were examined, no names or person signs, nor any of the modifiers and markers. To call these experiments vocabulary tests, then, suggests more than what actually happened in these tests. It gives the impression that all of the signs within the different chimpanzees' vocabularies were tested under double-blind conditions, their acquisition thus solidly proven. The most proper name of the tests is

therefore "object sign tests." This covers the content of the actual tests and is therefore more appropriate and accurate.[76]

All four chimpanzees were successful in the tests. In the slide tests, Washoe, Tatu and Dar produced the correct sign in high percentages, ranging from 71 to 88%. Moja's correct percentage was somewhat lower, at 54%, though still beyond chance expectancy (Gardner & Gardner, 1984, 1989b). For Washoe's box test, the results of two sessions are mentioned: she named 53 out of 99 exemplars correctly (Gardner & Gardner, 1971).

The vocabulary tests thus are good, solid evidence that the chimpanzees acquired signs for all kinds of different objects and that they understood the meaning of these signs.[77] The Gardners also interpreted the success of the chimpanzees in the tests as an argument for the conclusion that the chimpanzees, like humans, used the signs to refer to what are called natural language categories. That is, a symbol refers not only to one particular object for which it was learned, but to all exemplars of the referent, no matter how differently they are represented. Thus, "the sign DOG could refer to any dog, FLOWER to any flower, SHOE to any shoe, and so on" (1989b, p. 183). It appears then, that the chimpanzees divide "the world into the same conceptual categories that human beings use" (p. 193). The Gardners' argument for the presence of natural language categories is that there was significant variation among the exemplars used. Also, they refer to earlier work (such as that of Herrnstein, Loveland and Cable (1976) with pigeons) that demonstrated that nonhuman animals can use natural language categories when they are presented with varied stimuli.

Fouts (1973, 1975b) also used a double-blind object sign test with the four Oklahoma chimpanzees (Booee, Bruno, Cindy and Thelma) that he had taught ten signs. In a variant of the box test, the chimpanzees were presented twice with an exemplar of the nine object signs

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[76] Interestingly, the very first time that the Gardners talked about these tests, in 1971, they presented the experiments as "testing Washoe's use of nouns." In 1974 they say that these are procedures for "testing the nouns in Washoe's vocabulary." Only from 1978 onwards did they present them as "a test of vocabulary."

[77] See Part II of chapter 5, "The status of the signs: Symbols or conditioned responses?, for a discussion of the problem that the chimpanzees' success in these tests may have come about by stimulus generalization rather than constituting proof that the chimpanzees understand these signs' meaning.

that they had acquired. The chimpanzees had varying scores of correct responses: Cindy identified 26.4% correctly, while Booee was correct in 58.3%, Thelma in 59.7%, and Bruno even in a percentage of 90.3.

1.4.4. Terrace's determination of the signs' meaning. Terrace did not officially make use of obligatory context questions or Wh-questions tests in assessing the grasp of the signs' meaning that Nim acquired (though Nim was similarly presented with many questions to elicit his signs). Object signs vocabulary tests were used, however, to assess Nim' comprehension of signs (Terrace, 1979a; Terrace et al., 1980). In contrast with the Gardners' tests, these were not carried out under double-blind conditions. In Nim's tests, carried out in the classroom, a teacher would arrange several objects or would present Nim a familiar but closed picture book. The teacher would then ask Nim questions such as NIM WHERE BANANA?, SHOW ME BANANA or NIM YOU GIVE ME HANDCREAM. Behaviour by Nim such as pointing to or showing the correct picture or object, or bringing the requested object from the array of objects (which they claim Nim did appropriately and immediately), was considered adequate demonstration of his comprehension. Though the teacher took care not to look or point at the correct object, of course these conditions leave ample room for unconscious cueing by the teacher.

In terms of the reliability and validity of the acquired signs by all signing chimpanzees, and of the various semantic categories these signs were grouped into, one can say the following. All observations of these signs came from individual observations by the teams' observers. Though these observations were made repeatedly by separate observers on different occasions, they were not captured on a permanent record such as film or videotape (see sections 3.1. and 3.2. for a further discussion of this problem). The Gardners' systematic use of evoking the signs in the controlled obligatory contexts, as well as their application of Wh-questions and object signs tests is a more thorough assessment of the individual signs than Terrace and his team used in Project Nim. Especially the double-blind procedure in the

object signs vocabulary tests makes the Gardners' data more stringent than those of Terrace (even though the tests were limited to individual object signs only and not to other semantic categories).

1.5. Frequency of signs.

Though the Gardners used more systematic and stringent data collection procedures, Terrace and his team were more extensive and detailed in the presentation of the actual ways that Nim used his signs. They came up with several detailed descriptions and analyses of the frequency of individual signs and combinations of signs made by Nim.[78]

An especially detailed picture is offered in 1980, where Terrace's team presents extensive data on the frequency of the signs used by Nim. They were derived from analyses of five different periods in the last two years of Project Nim. These five data collection periods fell in between June 1, 1975 and February 7, 1977. They were arbitrarily chosen and covered several months of daily sign use by Nim, ranging from a shortest period of 35 days to the longest of about 7 months.

Figure 8-2 in 1980 presents the cumulative number of days that each sign in Nim's vocabulary at the time was made spontaneously (by Nim) for the first period (June 1 to December 20, 1975). Table 1 then lists the twenty-five most frequent signs during each of the five respective periods. Each of these signs is presented according to rank of frequency, and the exact frequency of use is then given in the form of the number of times it was observed to be made spontaneously in that period. Additionally, besides this information on the 25 most frequent signs, we are given the total number of different signs made in each period. This is highly valuable material, because it gives a detailed insight into the production of signs by the chimpanzee during a considerable period of time. Reproduced here in Table 2.3. are the

[78] Most of these tabulations, however, were based on the observations entered in the teachers' reports of Project Nim, and were not part of an analysis of filmed or videotaped material.

ten most frequent signs of each of the five periods, together with their frequency and the total number of signs made in each period.

Table 2.3. Nim's ten most frequent signs with their exact frequency in five periods.

	Period I 6/1 – 12/20/75		Period II 1/5 – 2/29/76		Period III 3/1 – 3/29/76		Period IV 4/5 – 7/4/76		Period V 7/5/76 – 2/7/77	
1	EAT	360	ME	169	PLAY	219	PLAY	767	HUG	1650
2	TICKLE	356	PLAY	156	HUG	174	EAT	515	PLAY	1545
3	DRINK	327	HUG	138	ME	169	HUG	440	FINISH	1103
4	MORE	320	TEA	99	EAT	137	DRINK	321	EAT	951
5	OPEN	299	MORE	75	GIVE	101	NIM	273	DIRTY	788
6	BRUSH	256	DRINK	73	BANANA	99	ME	267	DRINK	712
7	HANDCREAM	234	EAT	65	TICKLE	94	OPEN	211	OUT	615
8	GIVE	229	TICKLE	62	DRINK	87	ANGRY	205	NIM	613
9	SHOE	196	NIM	56	MORE	85	TICKLE	186	OPEN	554
10	PLAY	186	BANANA	50	NIM	81	TOOTHBRUSH	166	TICKLE	414
T	33		50		60		106		157	

T = Total number of different signs observed in this period.

Note that four signs keep showing up among the ten most frequent signs in the different periods. Presented here in order of rank of cumulative frequency in all five periods, together with their total number of observations, they are: PLAY (2,873), EAT (2,028), DRINK (1,520) and TICKLE (1,112). Indeed, Seidenberg and Petitto (1981, 1987) mention "that Nim relied extremely heavily upon a small set of signs. In fact, seven signs – *Nim, me, you, eat, drink, more,* and *give* – account for a very high proportion of the signs in their published corpus" (1981, p. 122). For each of the five periods mentioned above, these seven signs accounted for 43 to 47 % of the data. Their presence in combinations of signs was similarly very high. The seven signs took up 84 % of the signs in the 25 most frequent two-sign

utterances, and 83 % of signs in the 25 most frequent three-sign utterances. In a paper that discusses many of the issues in the controversy, Seidenberg (1986) concludes that Nim's production of signs was thus "highly skewed": "A small number of signs (principally the above seven) occur very frequently; the remaining signs occur very infrequently" (p. 43). The presence of these signs thus occurred with a "numbing regularity." Looking at the nature of the seven signs, Seidenberg and Petitto (1981) see them having an important quality:

> Note that the pool of favorite signs has an interesting property: they are semantically "appropriate" in nearly every context. That is, signs such as *Nim* or *eat* could always be interpreted as correct. .... In producing these signs, Nim appears to have developed a very simple strategy for signing "correctly" regardless of the context. (p. 122)

The seven signs were then called "wild card" signs, because they functioned as wild cards in a card game, being always appropriate.

This information sheds a different light on the published vocabulary lists of the signing chimpanzees. Without data on the frequency of use, one might imagine that all the signs in the vocabulary of a chimpanzee are used regularly. However, the frequency data of Nim's sign use demonstrates that his vocabulary list of signs gives a very limited view of his regular sign use. A vocabulary list by itself does not allow to determine whether certain signs were made extremely frequently, while other signs almost never appeared beyond the criterial instances when learning the sign.

Information has also been given about the frequency of the different semantic categories in Nim's vocabulary. Though, as was mentioned before, Terrace did not present a classification of all of Nim's signs into semantic categories, from some of his publications it appears that he nevertheless worked with some sort of a categorization system. In two publications (1981 and 1984) he reports that "common and proper nouns" were the most frequently used by Nim, followed by "verbs and adjectives", with "pronouns and

prepositions" being the least frequent.[79] In the next section, on the combinations of signs that the chimpanzees produced, we will see that Terrace also provides valuable detailed information on the frequency of certain types of combinations.

Such material on the frequency of the individual signs has not been published by the Gardners. Their focus on listing the signs within vocabularies gives no insight into the daily use and frequency of the chimpanzees' signs. The only times that the Gardners present data on the frequency of signs used by their chimpanzees, is the video record of Dar's interactions with Tony McCorkle (Rimpau et al., 1989) and some information in the presentation of Washoe's combinations (Gardner & Gardner, 1969, 1971). In the Dar video study, the Gardners were able to determine that Dar used a sign in 1,531 times.[80] Table 6.3 in the chapter presents the frequency for each of the 71 individual signs that Dar used in this corpus. Presented here is the top ten, together with their frequency.

1. DAR: 153 times.

2. EAT: 93 times

3. HAT: 77 times.

4. YOU: 73 times

5. MINE: 70 times

6. PLEASE: 68 times.

7. GUM: 67 times.

8. GOOD: 65 times

9. THAT: 64 times

10. DRINK: 61 times.

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[79] Notice that Terrace, in the same way as the Gardners and Fouts, uses syntactic categories here, without there being any justification for these terms. This is especially remarkable because Terrace is of the opinion (as will be discussed later) that the signing chimpanzees do not produce actual sentences and grammar and syntactical categories are therefore inappropriate terms to describe their utterances. Terrace's remark here, as well as the Gardners' use of the syntactic terms 'nouns' and 'verbs,' may show that in the ape language debate there has been some conceptual confusion or muddledness with regards to a clear distinction between semantic and syntactic categories (as was the case in child language research, see the remark by Braine in footnote 64).

[80] Eight interactions between Dar and Tony were analyzed for this study. Together these sessions consisted of 105 minutes in total.

In the discussion of the combinations of signs that Washoe produced, the Gardners have given some data on the frequency of particular combinations (see also the next section on Combinations). They attest that 82% of a sample of 272 combinations contained one of the following 12 signs (presented here in order of frequency of production): COME/GIMME, PLEASE, YOU, GO, ME, HURRY, MORE, UP, OPEN, OUT, IN, FOOD. Furthermore, the request markers in this group, GIMME, PLEASE, HURRY and MORE, occurred in 120 combinations or 41% of Washoe's total (Gardner & Gardner, 1971). In an earlier publication (1969) the Gardners mention that five signs accounted for most of Washoe's early combinations. These were GO, OUT, IN, OPEN, and HEAR/LISTEN. This information is all, however, that the Gardners have given on the details of the frequency of the chimpanzee signs.[81]

The Fouts have published several frequency data on the use of the chimpanzees' signs. They did so when they presented the sign use by Loulis, the signing by the chimpanzees amongst themselves, and their private signing. Details on Loulis' developing use of signs are given in Fouts, Hirsch & Fouts (1982). The frequency of Loulis' signing is given from monthly samples. In July 1979 there were 27 instances, in November 1979 there were 47, increasing to 282 in May 1980, 228 in October 1980, 267 in November, 182 in December 1980, and 636 in January 1981. Figure 4 lists Loulis' average number of signs per hour of observation. In July 1979 this number ranged from 0.04 to 0.27. By May 1980 it had increased to a range of 0.99 to 4.16. Figure 5 lists the monthly number of times that Loulis used one of his acquired signs, for a four-month period from October 1980 to January 1981. The following are his totals of signs used in an appropriate context: COME/GIMME: 1,176

[81] As for the useful information in this respect that could have come from the comprehensive samples that the Gardners collected for Washoe (see the datacollection methods in chapter 1), only once are we presented with data that derived from this procedure. In their 1971 article they specify the number of signs that Washoe made during the supper meal (usually the event that was sampled). They found that this number tripled between November, 1968 and June, 1969: from 50 to 150 signs. The signs FOOD, SWEET and DRINK were more frequent during mealtimes than during play, but TICKLE, PEEKABOO and GO were made frequently during play, but rarely during meals. GIMME, MORE and PLEASE were frequent in both these situations. YOU and ME were "far more frequent" during play than during meals.

times. HURRY: 62 times. THAT/THERE: 22. TICKLE: 18. HAT: 13. DRINK: 9. WANT/DESIRE: 5. HUG: 3. BIB: 2. YOU: 2. ME/MINE: 1.

In Fouts and Fouts (1989) a table (9.4) was published that includes all the signs that Loulis was supposed to have used in 54 signed interactions, together with the frequencies of these signs. Only Loulis' signs are presented though, and not the other chimpanzees', as the focus of this chapter was on the use of signs by Loulis in his conversations with the other four chimpanzees. HURRY was Loulis' most frequently produced sign. It was used in 134 times (or in 65%) of the total of 206 times that he made a sign. Other frequent signs were ME/MINE (17 times), COME (13), and GOOD (11). The remaining signs that he used were: MORE (7 times), DRINK (6), PEEKABOO (4), WANT (4), GUM (3), PERSON (3), GIMME (2), SHOE (1), and TICKLE (1).[82]

The two studies by Bodamer on the private signing of the chimpanzees contain a complete presentation of all the signs detected on the videotapes, with the frequencies for each sign and utterance, specified for each of the five chimpanzees. Thus, in the first, unpublished study (1987, Bodamer's thesis) the 91 private utterances signed in 45 hours of tape are literally specified. Twenty-six different signs were used. Analyzed for frequency, it was found that PEEKABOO was the most frequent utterance, made 22 times. DIRTY was next frequent, with 21 times. THAT occurred 7 times, FOOD 6 times. DRINK and the combination THAT FOOD were produced three times. BANANA, HUG, GOOD, HURRY, SHOE, CLEAN and HAT occurred twice. The other 15 utterances occurred only once. These were: APPLE, BERRY, BIRD, BLANKET, BOOK, DOG, GROOM, MASK, PERSON and TOOTHBRUSH, and the multiple-sign utterances: BLANKET CRY, DEB DIRTY DEB, HURRY GOOD MINE, HURRY OUT, THAT SHOE THAT. Information about the individual chimpanzees' use of signs presented here, is that DIRTY occurred in 76% of

[82] Their 1984 article on chimpanzee conversations contains very little information on the frequency of individual signs used. There is information on the number of conversations for each month of the period of analysis, as well as how many of these interactions were initiated by which chimpanzee. However, exact

Washoe's 25 instances of private signing. Moja only had three instances, using two different signs in these. Tatu had seven privately signed utterances, consisting of six different signs. Dar, who made the most private utterances in this study (32 instances), most frequently used PEEKABOO, in 65.6%. THAT was the sign that Loulis most frequently produced here (20.8% of his total of 24 instances).

The second study, published in 1994, analyzed 56 hours of tape, and found 368 instances of private signing. In Table 4 of that publication, all of these utterances are presented, together with their frequency, grouped according to the functional categories of private signing. To calculate the total frequency of the individual signs and utterances, one has to add the numbers in these categories. The following frequencies result. There was a total of 88 utterance types. The 12 most frequent utterance types were (token frequencies in brackets behind the number): THAT (98), FLOWER (36), PEEKABOO (24), BOOK (18), FOOD (12), RED (12), BLACK (10), CAT (8), DIRTY (8), BUG (7), PERSON (7), and THAT MILK (7). Notice the high proportion of 1-sign utterances. Altogether, 1-sign utterances took up 82.4% of all utterance tokens, 2-sign utterances 12.8%, 3-sign utterances 4.3 % and, lastly, the two 5-sign utterances consisted of .5%. The article by Bodamer, Fouts, Fouts and Jensvold (1994) also presents details on the individual chimpanzees. Washoe's most frequent sign was FLOWER, used in 39% of her 84 instances of private signing. For Moja, the most frequently occurring sign was PEEKABOO (19% of 91 instances). Tatu produced THAT in almost half of her private utterances (49% of 163 instances). Dar and Loulis did not have a sign that occurred more than twice in their private utterances. Their totals were 9 and 21 instances respectively.

When these frequency data are compared with the systematic frequency analyses of Nim's sign use, there appears to be a similar pattern in all signing chimpanzees. Though they

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frequency information is only given for one sign in particular. This is that during one month Moja signed HUG to Dar in a total of 211 times, while she was at "maximum tumescence."

may have large vocabulary lists, certain particular signs sometimes cover large percentages of the total sign use in specific situations.

Conclusion

Both the Gardners and Fouts, and the Nim team, agreed that the signing chimpanzees had acquired considerable vocabularies of signs that were an active, integral part of their communicative behaviour. The total number of acquired signs in Nim's vocabulary was 125. Washoe had 132 reliable signs at the end of the Gardners' project. The chimpanzees in their second project acquired vocabularies ranging between 122 and 168 signs. Strict acquisition criteria were used before a sign was considered to be acquired or reliable. The gloss of a sign was mainly determined through its use by the chimpanzee, and sometimes differed from the meaning of the equivalent English word.

Both teams were of the opinion that the chimpanzee subjects' vocabularies contained signs in the following semantic categories: objects, actions, names, person terms, locations, colours, qualities, request markers, traits, and a rest category. The Gardners also considered it to be substantiated that their cross-fostered chimpanzees had furthermore acquired signs for generic names, possessives, materials, quantitatives, comparatives, as well as certain question signs. According to them, there was a striking similarity of the chimpanzees' early vocabulary with that of human children.

Several methods were used to determine the meaning or appropriate use of a sign. Among these, a double-blind procedure to test the object signs was used by the Gardners. Terrace only used nonblind tests for Nim's vocabulary.

In terms of frequency data on the use of the individual signs, the Terrace team provided extensive analyses and detailed information. The Gardners and Fouts also gave information on the frequency of certain signs on several occasions. Especially the private signing studies stand out in this respect. A common pattern in all signing chimpanzees

appears to be the presence of certain signs that are used very frequently, despite the existence of large vocabulary lists.

CHAPTER 2

THE RESULTS OF THE PROJECTS WITH SIGNING CHIMPANZEES

2. COMBINATIONS

In this subchapter the nature of the combinations of signs that the chimpanzees in the different projects produced will be examined. First, some information will be given on the mean length of utterances of Nim's signed communications (it was not calculated for the other chimpanzees). Then the semantic structure of the combinations will be analyzed, in terms of possible semantic relations expressed in two-sign combinations. Creative production of novel combinations of signs to refer to an object or picture for which the chimpanzees did not yet have a sign, is next presented. Following this, the grammatical structure of the chimpanzees' combinations will be assessed. The findings on sign order preferences and the use of inflectional devices to express grammar will be mentioned and compared. This subchapter will end with a presentation of the nature of the chimpanzees' multiple-sign combinations with a length beyond two signs.

Soon after the signing chimpanzees had acquired their first signs, they started combining signs in sequences that might be considered as separate utterances. These combinations at first consisted of two or three signs. Combinations of four signs and more followed quickly. Washoe began to combine signs after she had acquired her first eight or ten signs. Her first observed combinations were GIMME SWEET and COME OPEN. These occurred in the 10th

month of the project, in April 1967 (Gardner & Gardner, 1971). The first documented combinations that Nim made were MORE DRINK and MORE EAT. They occurred in March 1975, about 15 months into the project. Soon he produced many more combinations, such as BANANA THERE, ME MORE DRINK, TICKLE ME NIM and GIVE ME EAT APPLE (Terrace, 1979a; Terrace et al., 1980). The chimpanzees of the Gardners' second project made combinations at even earlier ages. They had produced ten different combinations by the age of six months (Tatu) and seven months (Moja, Pili, and Dar) (Gardner & Gardner, 1978, 1980). Loulis' first combination occurred after five months with Washoe and was HURRY GIMME. A sample of his two-sign combinations from a period between October 1980 and January 1981, showed that the following four were his most frequent: HURRY COME (26 times), GIMME THAT (7x), COME HURRY (6x) and THAT GIMME (3x).

2.1. Mean Length of Utterances.

An instrument with which to analyze the combinations of words and signs is the Mean Length of Utterances, abbreviated as MLU. It is one of the measures with which to map the progress of language development in human children (Bowerman, 1973a; Brown, 1973; Brown & Bellugi, 1964; Wells, 1985). In this measure, the mean number of morphemes of a sample of utterances can be calculated at any point in time. As children are acquiring language, their MLU progressively increases. The utterances become longer and their complexity increases (Terrace, 1981, 1982b; Terrace, Petitto, Sanders & Bever, 1979, 1981). English speaking children, for example, will continue from subject-verb and object-verb constructions into utterances that contain all three syntactic roles: subject-verb-object combinations. Obtaining evidence of a steadily increasing MLU is therefore considered to be a sign of stable language acquisition.

In order to analyze the chimpanzees' combinations of signs a similar track could be kept of the development of their MLU. This is what the Terrace team did for Nim's

productions. For each month in a consecutive period of 19 months towards the end of Project Nim (January 1976 through August 1977), the MLU of Nim's utterances was calculated. It was found that there was no increase at all in the mean length of Nim's utterances during this period. Instead, Nim's MLU kept fluctuating between the value of 1.1 and 1.6 signs. Terrace et al. (1979) consider this to be one of the most important findings of their project, and one of the clearest differences with human children acquiring language. In 1980 they interpret this as "a major difference between the development of language in young apes and children" (p. 418).

A further difference with respect to the MLU is that the upper bound of the length of utterances of children is closer to the mean length of their utterances. Thus, when children are at an MLU of 2.0, their upper bound is about 5 ± 2. With Nim the upper bound of the length of his utterances, despite his lower value of 1.6, is much higher, going up to 16 (Terrace et al., 1979).[83]

The Gardners and their colleagues did not calculate the MLU of their chimpanzee subjects. Instead they criticized the application of the measure to the sign utterances of chimpanzees (B. Gardner, 1981, 1982a). They point out that the calculation of the MLU was set up for spoken language and is not easy to transfer to a sign language. There is no generally accepted method by which one can apply the measure to sign languages. Instead of using the MLU, Beatrice Gardner (1981) says that it is more appropriate to calculate the percentage of utterances longer than one morpheme. This is less susceptible to distortions, so they applied this to the utterances of their cross-fostered chimpanzees.[84]

O'Sullivan, Fouts, Hannum and Schneider (1982) confirm that the MLU measure is problematic, because in sign language certain information can be produced simultaneously (making use of the separate components of a sign and additional facial and other nonverbal features) and thus can make do with less units of signs than in spoken language. Calculating

[83] See page 117 of this dissertation for Nim's longest utterance.

the MLU of signed utterances would thus always produce a smaller mean than the spoken sentences of human children. The measure then, would always reflect badly on the signing chimpanzees' productions.

In his presentation of Nim's MLU, Terrace (1979a; Terrace, Petitto, Sanders & Bever, 1980) shows that he understands the problems that exist with calculating the measure for signed languages. Indeed, he calls it a "rough measure." Nevertheless, he considers it important to apply this method to Nim's utterances, in order to have a wider understanding of the general length of his utterances.[85]

Aspects of combinations analyzed in the projects.

Besides measures that calculate the length of utterances, the attention has centered on possible structure and characteristic patterns in the sequences or combinations of signs that the chimpanzees produced. The first question in this respect was to see whether the chimpanzees actually related the signs within a combination to each other. Was there some sort of structure to be discovered, or were they simply sequencing signs with no system that connected the signs together? Could the combinations be interpreted to have a semantic structure in the form of semantic relations, where the semantic roles of individual signs are connected? Another issue that was addressed was whether the chimpanzees spontaneously

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[84] She does not present the percentage though, and apart from this publication this particular measure is not mentioned again by the Gardners.

[85] Edward Klima and Ursula Bellugi (1972), two pioneers in the linguistic study of sign languages, also pointed out that there are problems with calculating the MLU for signed languages (in that it in general somewhat favours spoken languages). Even so, they had no qualms about using the measure and found it to be a very useful one to analyze the developing linguistic progress of signing children. Calculating the MLU for the deaf child Pola, they found a dramatic increase of the mean length of her utterances: it progressed from 1.7 signs at 2 years and 7 months to 2.8 when she was at age 3:0. This progress was "entirely comparable" with that of hearing children Klima and Bellugi compared Pola to.

In reply to Gardner's (1982a) criticism of MLU, Terrace (1982b) also makes the following rebuttal (to which there is no further reaction by Gardner):

> Gardner disparages MLU because Bellugi's and Hoffmeister's measures are not identical. They nevertheless each yield similar MLU functions of greater than zero slope, whereas Nim's functions calculated by *any* known method all have slopes of zero. In view of such dramatic differences, why the concern about methodology? (p. 155)

Of further importance in this discussion is the fact that in the sign language projects with gorillas (Patterson, 1978, 1979) and the orangutan (Miles, 1983) the MLU of their utterances was regularly calculated, using Hoffmeister's procedure. When Miles (1978) was with Fouts in Oklahoma, she even determined the MLU of the chimpanzees Ally and Booee.

made new, creative combinations of signs when confronted to give a description of an object or event for which they had not yet been taught the appropriate sign(s). The grammatical structure of the sign sequences has also been a subject of debate, centering particularly on the possible presence of sign order as a syntactical device. Lastly, the multiple-sign combinations of three or more signs have been interpreted and discussed with regards to their regularities and patterns, and compared with the multiple-word sentences that human children first make. All of these aspects of sign combinations led to some considerable differences of opinion between the Gardners and Fouts on the one hand, and Terrace and his colleagues on the other. These will now be presented.

2.2. Semantic structure: Semantic relations

When children start making combinations of words or signs they quickly produce patterns that express semantic relations between the words or signs (Bloom, Hood & Lightbown, 1974; Bloom, Lightbown & Hood, 1975; Bowerman, 1973a, 1973b, 1974; Braine, 1976; Brown, 1973; de Villiers & de Villiers, 1978, 1986; Goodluck, 1991; Klima & Bellugi, 1972; Schlesinger, 1971; Tomasello & Brooks, 1999; Wells, 1985). Within a semantic relation each word or sign expresses a semantic concept or notion. In other words, each word or sign has a semantic or thematic role. Among these concepts or roles are *agent* (or *actor*), *object, action, attribute,* and *location.*[86] The combination then expresses a relation between the two notions or roles of the words or signs. Consider for example the *Agent+action* relation. This relation can express itself in many different varieties, but in each case the two combined words or signs express an action that an agent or actor is doing. In each instance of this relation one

[86] Brown (1973) has given good definitions of these semantic roles. An actor can be either an agent or patient. An agent is someone or something which causes or instigates an action or process. The agent can turn into a patient, someone or something in a given state or suffering a change of state. Location is the place or locus of a state, action or process. Notice the similarity of most of these semantic roles with the semantic categories in section 2.1.3. The semantic roles are of course constructions by scientists in order to classify child utterances. They may not express the exact categories or notions present in the child's mind (Bowerman, 1973a, 1973b, 1974; Brown, 1973). However, these roles are the most likely ones when one takes into account the utterances children make and the context into which they are uttered. Future research may further modify these the particular categories.

word or sign has the semantic role of agent, for example "Mommy," "Daddy," "Eve," or "Adam." The other word or sign in the combination is then of the semantic role of action. Examples could be "sit", "walk", "run,", "drink," and other action words. The semantic structure of *Agent+action* then shows itself in combinations of these words and signs, as in "Mommy sit," "Daddy walk," "Eve drink," and "Adam runs."

A fairly small set of these semantic relations describe the meanings present in children's first word combinations. Besides **Agent+action**, there are:

- **Action+object**: Hit ball, Hold hand, Make bridge, Push button.[87]
- **Action/object+locative**: Light up there, Baby in, Lady home, Put on there, Sit chair.
- **Attributive relation: Entity+attribute**: Funny duck, Red book, Nice man, Light hot.
- **Possessive: Possessor+Possession**: My ball, Daddy chair, Andrew shoe, Bill book.
- **Nomination or Naming: Demonstrative+entity**: This book, That daddy, That candy, That cat.
- **Recurrence** (reappearance, appearance of a new instance, or an additional quantity of something): More cookie, Other shoe, Another cookie, More jump.
- **Negatives**, in three forms: nonexistence, rejection and denial: No bib, No more birdie, Can't see, It doesn't fit, Don't break it.
- **Experience/Notice**: I see monkeys there, Look in there, Look at the rabbit, I hear Kevin.
- **Requesting**: Want cookie, Want hold it, Gimme ball, Give me more, Please get down.
- **State**: Baby Nancy want a bottle , Baby sleep, I need that, I like the cole slaw.[88]

Klima & Bellugi (1972) reported on the presence of the same semantic relations for the signed utterances of the deaf child Pola at Brown's Stage I of language development. The

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[87] These examples are taken from the literature on children's semantic relations.

[88] There are still other relations that have been used by linguists in the past. Furthermore, continuing research has shown a diversification of certain semantic relations. Thus, it appears that the object-action relation in certain children is first only instanced by the action of movement (Braine, 1976). Also, children sometimes have rules of combining individual lexical items with one of the semantic roles. The semantic relations mentioned here, though, can be found in most constructed systems of semantic relations (Brown, 1973). Since these

examples they give include: Agent+action: MAN WORK; DADDY SHAVE. Locative: ME GO HOME; LETTY ME SCHOOL. Attributive: THAT PINK; MANY CANDY. Bonvillian (1999) also mentions research which demonstrates an equivalence in this respect between the language development of speaking and signing children (see also Hoffmeister and Wilbur, 1980).

According to the Gardners, the cross-fosterlings made phrases of two or more signs that demonstrated semantic relations (Gardner et al. 1989; Gardner & Gardner 1994a). In 1971 they published an analysis of structure in Washoe's first 294 different types of combinations. These combinations were obtained from written notes in the field records dating from April 1967 to June 1969. Basing themselves on Brown's scheme of semantic relations, they used the notes on the context in which the combinations were made to make an interpretation of which semantic relation was most likely being expressed in the combination. Eventually they could fit 78% of these combinations to the different types of relations, which is comparable to the 75% that Brown had found for human children's earliest combinations.[89]

In a table they gave 22 examples of Washoe's combinations that fit the different types of relations. ROGER TICKLE and YOU DRINK were examples in this table of the Agent+action relation. Action+object was represented by TICKLE WASHOE and OPEN BLANKET. Combinations with locations were GO IN, BABY DOWN. Instances of the attributive relation were DRINK RED and WASHOE SORRY. Representatives of the appeal or request relation in the table were PLEASE TICKLE and GIMME FLOWER.

The information that was given about the other 272 combinations was that 240 of these (82% of the total) contained at least one of the following 12 signs (presented here in order of frequency of appearance): COME/GIMME, PLEASE, YOU, GO, ME, HURRY, MORE, UP, OPEN, OUT, IN, FOOD. Combinations with request markers were relatively

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relations have also been discussed in the ape language debate, the presentation of relations will limit itself to these particular types.

[89] Bloom, Lightbown & Hood (1975) report a percentage of 88 % in a study of four children, who were followed up to an MLU of 2.5 morphemes.

high. Combinations with the four signs GIMME, PLEASE, HURRY and MORE accounted for 120 combinations, or 41% of the total.

In their first article on Project Washoe, published in *Science* in 1969, the Gardners had already mentioned that combinations with these last four signs took up the largest share of Washoe's early combinations.[90] They further said that "until recently" GO, OUT, IN, OPEN and HEAR/LISTEN accounted for most of the remaining early combinations.[91] They presented the following examples of combinations with these five signs, some of which did not appear later in the 1971 article. They are reproduced here, as they are given together with context notes:

"go in" or "go out"	(when at some distance from a door)
"go sweet"	(for being carried to a raspberry brush)
"open flower"	(to be let through the gate to a flower garden)
"open key"	(for a locked door)
"listen eat"	(at the sound of an alarm clock signaling mealtime)
"listen dog"	(at the sound of barking by an unseen dog).[92]

In their 1978 publication the Gardners discussed the first combinations that Moja, Tatu and Dar made within the first 12 months. All they said about these, however, was that they could be grouped into the categories of semantic relations. No percentage was given of the amount that fit into the categories. Nor was the method described with which they determined the presence of semantic relations, though from the text it appears that they were

[90] A number for the combinations analyzed for this article is not given, so it is unclear whether they refer to the same 294 mentioned in the 1971 article.

[91] The Gardners drew attention to the use of these particular five signs in combinations as a device to add emphasis (making these signs appear as still another sort of request markers): "Combinations of this type tend to amplify the meaning of the single signs used. Sometimes, however, the function of these five signs has been about the same as that of the emphasizers [the Gardners' term at this stage for request markers, referring to the earlier four of COME-GIMME, PLEASE, HURRY and MORE], as in "open out" (when standing in front of a door)" (p. 671).

[92] Interestingly, the Gardners mention that the first and last of these examples were learned from the humans using these expressions. The others are Washoe's inventions.

still using interpretation based on context notes from written records of observations. As in 1971, a few examples were given of meaningful combinations (8 in total).[93]

In a later article (1980), the Gardners gave a few more examples of combinations of the four cross-fosterlings from their second project that they interpreted to demonstrate semantic relations. Here they gave the percentage of "74 to 90 percent" of all combinations that expressed semantic relations. They then presented examples of the Agent+action relation made by Moja in her first year of age: SUSAN HUG, SUSAN BRUSH, NAOMI HUG, ME DRINK en YOU GO.[94]

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[93] In several publications the Gardners have talked about testing the cross-fosterlings' combinations by creating tests similar to the vocabulary tests for individual (object) signs, described in section 2.1.4.3. In 1969 they mention that something akin to the box test (the slide test had not been developed at that time) should test "the ability to combine and recombine signs" (p. 671). They also hope that they can bring Washoe to describe whole events and situations "to an observer who has no other source of information." In 1971 they mention that the slide test could be expanded to ask Washoe more than just the names for objects, and say that film could be used to ask her to describe the actions and actors depicted. In 1974a it is said that they will set up procedures, by expanding on the rigorous vocabulary tests, that can test the "combined forms" with the cross-fosterlings in the second project. Indeed, they call these the "next steps," where the chimpanzees will have to do more than just give an object sign for a picture or object. They mention that combinations of names with colour and even numerical modifiers (ONE and TWO) can be tested in this way. They can test locative constructions by presenting pictures with different spatial relations between objects of forms such as 'X behind Y', 'X in Y', 'X under Y', and then ask the chimpanzees WHERE X? or WHERE Y? On top of this, there are plans to even test the use of order by the cross-fosterlings. They fantasize about showing them short loops of film where relations between two beings can be reversed, such as 'A chases B' or 'B chases A', 'A feeds B' and 'B feeds A.' The chimpanzees will then need to use correct use of order when asked by the humans to describe such filmed sequences.

In 1978 they even have a separate section called "Test of combinations" after presentation of the vocabulary test, but again they just say that they can expand the latter. The text is closest to 1974a, but it is added that they will even be able to test grammatical inflections characteristic of ASL such as reduplication to represent plurality, special inflectional endings for the agentive suffix and directional modifications of signs to specify agent and object roles. For the plural they could present exemplars of singular and a plurality of books, trees and houses. To test the presence of agentive suffix, they could present pairs of exemplars such as boat and sailor, and kitchen and cook.

Sadly, none of these plans were ever realized. The reasons for this have never been given. It is only in 1974a and 1978 that these specific plans are mentioned at all, and never after 1978 do they show up again. The carrying out of these planned tests would have given further valuable information on the chimpanzees' use of signs and their combinations of signs into utterances.

[94] In 1980 they show further "significant" findings from a sample of 5 hours from Moja at the age of 42 months. She made 1,096 utterances in these hours, of which 424 were combinations, called "phrases" by the Gardners. In the food-sharing context she most frequently made combinations with the sign DRINK. In the context of preparing to go outdoors this was OUT, while in the toilet context this was POTTY. Each of these signs were then rare or absent in the other contexts. However, ME, HURRY, and THERE occurred in combinations within all contexts and were frequently used in more than one context (in more than 20% of all combinations).

Further interesting data is that the "possessor-possession" relation (such as MY DRINK, YOUR DRINK) was the most frequent combination type in the food sharing context. This means that this was the subject mostly "talked about" in combination utterances, suggesting a maybe routine, stereotypical nature of this particular context. A similar routine nature actually appears to be the case with the other contexts as well: Negative constructions (ME CAN'T, ME PLEASE POTTY CAN'T) were the most frequent combination type in the toilet context. Demonstrative+entity (THAT BOY, THAT ME) was most frequent in the context of looking through picture books, together with an apparent question Moja is credited with: WHAT THAT?

The Gardners (1994a) also examined the order of appearance of the different semantic relations within the utterances of the signing chimpanzees. In child studies a characteristic developmental sequence has been found in the appearance of the particular relations (Bloom, Lightbown & Hood, 1975; Bonvillian, 1999). The nominative relation ("That book," "That cat,"), together with the action relations (agent+action, object+action and action+locative) are the first relations to appear in the children's earliest combinations. At a later age, combinations that express attribution (the different relations that contain descriptions of attributions, possessions and locations of objects) start to come up. Combinations that express the Experience/Notice relation are relatively late in children's language development. For the negative and request relations there are as yet no such longitudinal data available that could pinpoint when these start to appear in the combinations of human children. However, the other three periods, according to the Gardners, are clear stages in child language development.[95] When the Gardners then looked at the longitudinal data of the chimpanzees, they found that the appearance of semantic relations showed an exactly similar developmental pattern. The cross-fosterlings first made phrases that expressed the nominative relation and the action relations. Only later in time did they start making descriptions of the properties of objects, their attributes, possession or location. And the last relation to appear in the chimpanzees' development was the Experience/Notice relation, expressed in combinations with SEE, HEAR, or SMELL.

Roger Fouts agreed with the Gardners' conclusion that the chimpanzees are capable of making meaningful combinations of signs. He denied that they were random in nature and

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[95] This conclusion has been contested by other researchers on child language (Bowerman, 1975; Braine, 1976; Maratsos, 1975). Bowerman argued that the apparent sequential emergence of the relations may have been caused by a sampling phenomenon. She pointed out that this can happen when one uses an arbitrary frequency criterion for a relation to have emerged (such as five utterances in a sample, the criterion used by Bloom et al., 1975, and, basing themselves on this, the Gardners). This "could easily cause utterances which are produced relatively infrequently to appear to emerge later than more frequent ones, even though a child might have been consistently producing utterances in each category from the start" (p. 83). In his study on children's first word combinations, Braine (1976) found the contrary of what Bloom et al. concluded. Though his focus was on productive positional patterns, he found that there was much variety among children in which particular relations were the earliest to appear. He found no evidence for a common order of emergence of the patterns. Instead there were wide individual differences among the children in this.

even claimed that Washoe's combinations "always made sense in whatever context she used them" (1997, p. 102). Fouts explicitly stated that "Washoe only used signs in her vocabulary that were relevant to the situation, and she did not pair signs in nonsensical ways, like [in a context of caretaker Susan stepping on Washoe's doll] BABY SUSAN, SHOE BABY, YOU SHOE, and so on" (p. 102).

Terrace on semantic relations.

In order to make plausible inferences about possible semantic relations in Nim's combinations the Nim team also made use of interpretation. Taking the context into account in which the combinations were made, they tried to interpret the combinations as expressions of specific semantic relations (Terrace et al., 1979, 1980). They analyzed a corpus of 1,262 two-sign combinations, produced by Nim between the age of 25 to 31 months (December 1976 - June 1977). The earlier teachers' reports were inadequate for this task, since these contained too little information on the context in which the combination of signs was produced. It was for this reason then, that sessions between Nim and the humans were videotaped in the first place. The videotapes were transcribed by the teacher who had functioned as human interlocutor on the tape. This teacher then interpreted Nim's two-sign combinations in terms of semantic relations. Another teacher coded the same segments, using the transcribed record. Nim's teachers reached agreement in their interpretations in a total of 957 combinations of the original 1,262. A high percentage of 84% of these 957 could then be assigned to the different semantic relations (Terrace, 1979a).[96] Examples of the categories of semantic relations, presented in order of frequency, were:

- **Action + Object**: EAT GRAPE, DRINK TEA, and OUT SHOE. Percentage of all 2-sign combinations in this corpus: 27 %.
- **Object + Beneficiary**: FOOD NIM, ICE NIM, YOGURT NIM. 16 % of total.

- **Entity + Place**: BABY CHAIR, FOOD THERE, BANANA HOUSE. 6% of total.
- **Routine** combinations: OUT PANTS, IN PANTS. 6% of total.
- **Attribute + Entity**: RED APPLE, ORANGE BALLOON, HUNGRY ME. 5% of total.
- **Action + Place**: CLEAN THERE, OUT THERE, TICKLE THERE. 5% of total.
- **Agent + Action**: BILL RUN, NIM OUT, NIM WASH, ME OPEN. 3% of total.[97]

Though interobserver agreement was reached for these assignments, Terrace (1979a; Terrace et al., 1979, 1980) eventually became skeptical about the validity of this particular analysis, for two specific reasons. The first cause of his skepticism was the small number of signs that was used to fulfill the different semantic roles. For example, a high percentage of 90% of location relations only involved the use of the locative sign POINT. The recurrence relation was solely represented by combinations with the sign MORE. Further findings were the following:

> In combinations presumed to relate an agent and an object or an object and a beneficiary, one would expect a broad range of examples - NIM, ME, YOU, and names of other animate beings. However, 99 percent of the beneficiaries in utterances judged to be object-beneficiary combinations were NIM and ME, and 76 percent of the agents in utterances judged to be agent-object combinations were YOU. (1979a, p. 214)

In contrast, when children start combining words and signs they generally quickly express the semantic relations by a larger variety and greater richness of words or signs for each semantic role within the combination. Not only will they produce "Eve eat," but also "Adam eat," "Daddy drink," and so on.

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[96] Conflicting numbers are given in the different publications. Terrace (1983) also gives the number of 957 2-sign combinations, but in Terrace et al. 1979 and 1980, the number presented is 967 utterances, of which 93 percent could then be assigned to semantic relation categories.

[97] One further category is presented that in effect does not demonstrate a relational structure between the two signs of the combination, but can be interpreted as chaining two single utterances. This category was called Two propositions (Brown (1973) classified it as *conjunction*), and was found in 16% of all the two-sign combinations. Examples are: EAT TICKLE, DIRTY HUG and OUT OPEN.

The other reason why the interpretation of Nim's 2-sign combinations as semantically related was drawn into question by Terrace and his team, was the large role of imitation they later found to take place in the interaction between Nim and his human caretakers (see section 2.3.). Since the corpus used for the semantic relation analysis was not made up of combinations where imitation from the humans had been excluded, the whole assignment of the 900+ instances to semantic categories had therefore become useless. Indeed, these utterances might now well be "to some extent, reflections of teachers' signing habits," (Terrace et al., 1979, p. 896).

Sanders (1985) has pointed out that finding patterns of combining suggestive of semantic relations in the apes' utterances are no proof of semantic relational competence. Since the apes imitated the humans to a considerable extent, imitation could therefore give the utterances a "semantic relational look," without there actually being an applied structure. Only when patterns of semantic relations are found on videotaped interactions where one can sift out those utterances that are imitations of the humans, can one draw conclusions on this aspect of combining signs.

Another important remark by Sanders on this subject was that it was of great importance for the apes to produce signs in order to acquire things in the routine situations in the different signing projects. The humans may then well have reacted more quickly with fulfillment of requests, when the apes produced strings of signs that had this relational look, which in the perception of the humans were meaningful, sense-making utterances. This may have caused the chimpanzees to produce more combinations of such a kind. Besides imitation as a source for making these ostensible semantic-relations patterns, Sanders mentioned that all the chimpanzees in fact needed to do was to combine object and action signs with general purpose signs such as ME and NIM, or signs related to objects that the human had drawn attention to by nonverbal means.

Terrace et al. (1979) drew attention to the fact that there was no detailed information on the combinations of signs by the Gardners' chimps that were deemed to show semantic relations. Especially because of the lack of knowledge on what the human had just signed, there was no way to test anymore combinations such as NAOMI GOOD. These might well have come about by the human manipulating the chimpanzee's production of signs by prompting and rewarding, and the ape imitating the human signs.

2.3. Creative combinations.

A claim by both the Gardners and Fouts was that the chimpanzees invented novel combinations of signs from their vocabularies in order to describe objects or events for which they had not yet been taught the appropriate sign(s). The most famous example of these so-called "creative" combinations was the two-sign combination WATER BIRD. This combination was made by Washoe in Oklahoma when Fouts had taken her for a boat ride in the pond surrounding the chimpanzee island (which he often did). The water was inhabited by two "very territorial and nasty swans," (1975b, p. 382). Fouts asked Washoe WHAT THAT? as a request to describe the swan he was pointing to. Fouts himself referred to the swans by the sign DUCK. Therefore, Washoe did not learn WATER BIRD from Fouts, but spontaneously created this apparently meaningful combination (Fouts, 1975b; Gardner et al., 1989).

Other published examples of creative combinations were:

- Washoe: OPEN FOOD DRINK for refrigerator (Gardner et al. 1989).
- Washoe, after being asked to describe her toilet, signed DIRTY GOOD for her toilet (Gardner & Gardner 1980).
- Moja, when asked WHAT THAT? of a cigarette lighter: METAL HOT (Gardner & Gardner, 1980).

- Moja, when asked WHAT THAT? of a thermos flask: METAL CUP DRINK COFFEE (Gardner & Gardner 1980).
- Moja, when asked WHAT THAT? of a glass of Alka-Seltzer: LISTEN DRINK (Gardner & Gardner 1980).
- Lucy called a radish CRY HURT FOOD (Fouts, 1975a, 1975b).[98]
- Lucy, for a quarter piece of watermelon: CANDY DRINK.
- Washoe once signed a new combination GIMME ROCK BERRY. The human then went to ask Washoe about this "seemingly incorrect sign," but found that Washoe was pointing at a box of Brazil nuts on the other side of the room (Fouts & Rigby, 1977). "In other words, this is an item that has the hardness of a rock and yet at the same time the fruit or edible portion comparable to a berry" (Fouts & Mellgren, 1976, p. 330)
- Ally described a Tootsie Roll candy bar as BANANA SWEET (Fouts & Mellgren, 1976).
- Booee signed STRING PIPE FOOD for some chewing tobacco (Fouts & Mellgren, 1976).

The Gardners concluded in 1989 that: "The number and variety of chimpanzee-invented combinations in the records indicates that the cross-fosterlings used the signs productively to construct new terms to suit new referents" (p. 81). Fouts and Mellgren (1976) mentioned that these particular combinations occurred "quite often."

Terrace and his colleagues (1979) felt that it was important that Nim's combinations should not immediately be interpreted as actual sentences or meaningful structures: "The simplest explanation of Nim's utterances is that they are unstructured combinations of signs, in which each sign is separately appropriate to the situation at hand" (p. 893). All that therefore might have happened in the purported instances of creative combinations was that the chimpanzees were stringing signs that were all relevant to the situation but individually unrelated to each other. Thus, when Washoe signed WATER BIRD, she might have

[98] This and the following example are from the 'conceptualization study' with Lucy.

appropriately replied to Fouts' WHAT THAT? question by mentioning both the water and the bird that were present in the situation (see also Terrace 1979a).

What also may be the case is that a combination such as WATER BIRD may have been randomly generated, in the same sense as a chimpanzee might hypothetically eventually create a line from a Shakespearean sonnet by randomly hitting keys on a machine that produce words (Terrace, 1979a).[99] Terrace has said that one cannot assess the possibility of meaningless and random combining with all signing chimpanzees. This is because the other projects have never published systematic analyses of the sign use or exhaustive listings of all combinations. Instead they have rather centered around incidental occurrences presented in anecdotes (see also sections 3.1. and 3.2.).

2.4. Grammatical structure.

2.4.1. Sign order.

Children use word order to express most of the semantic relations and are fairly consistent in doing so (Bloom, Lightbown & Hood, 1975; Bowerman, 1973a; Braine, 1976; Brown, 1970, 1973; De Villiers & De Villiers, 1986; Wallman, 1992). Some variation in order may occur, but this is usually in the early stages of emergence of a semantic relation. Braine (1976) referred to this variable word order as a "groping pattern."

Early on children also show evidence of having acquired syntactic categories. Thus they understand the syntactic roles of words in the form of word classes such as nouns, verbs, adjectives, prepositions and articles. They make sentences consisting of a noun phrase (the subject) and a verb phrase (the predicate) (Frijn & De Haan, 1990; Goodluck, 1991, Wallman, 1992). Tomasello (1992; Tomasello & Brooks, 1999) has shown that English-learning children in their early syntactic development make use of what are called "verb

island constructions," in which syntactic marking occurs independently for different scenes. This is especially the case with verbs: "each verb seemed like its own island of organisation in an otherwise unorganised language system" (Tomasello & Brooks, 1999, p. 170). Children first express the syntactic roles on a verb-specific basis. For example, they first learn that in English the "thrower" comes before the specific verb "to throw" and the "thing thrown" after the verb, instead of first learning the position patterns of the general syntactic roles of agent and patient for all verbs. Only later do children move beyond the verb island constructions and produce linguistic constructions that mark syntactic roles across all verbs.

Children also quickly learn whether their language is left-branching or right-branching. This refers to the position of the head and of the modifiers within a phrase. The head of a phrase is, roughly, the main element in that phrase. The words connected to this head are called the modifiers, or the modifying material. In a phrase such as "give presents," 'give' is the head, while in a phrase such as "presents wrapped in paper," 'presents' is the head. In all natural languages the internal structure of the verb phrase has either the head of a sentence preceding the modifiers (as is generally the case in English), or the modifying material preceding the head (as in Dutch). English is thus a head-first or head-initial type language and Dutch a head-final type. Children learn early in their combination phase of words how to set this particular parameter of their language (Frijn & De Haan, 1990; Goodluck, 1991).

During their preschool years, from about two and a half years of age onward, children start learning more aspects of adult grammar. They produce relatively abstract adult-like constructions for whole classes of scenes (Tomasello & Brooks, 1999). They learn to produce adult-like forms of sentences. Declarative sentences become more complex, in English speaking children the subject+verb+object format develops by about thirty months. They also develop their interrogative and imperative sentence types, as well as the negative forms of all

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[99] Seidenberg & Petitto (1979) have similarly drawn attention to the possibly random nature of the chimpanzees' combinations of signs. They compared the signing apes to random sign generators which

these sentence types. Later they learn how to start embedding phrases or clauses within a sentence. (A phrase is a group of related words without a subject and a predicate, whereas a clause is a group of words with a subject and predicate.) For example, the clause "who laughed" can be embedded within the main clause "the boy is funny," to produce the sentence "the boy who laughed is funny." Still later, they are conjoining sentences. In this process, they combine "the cat meowed" and "the dog barked" by using conjunctions such as "and, but, because, if" (in English) to the compound sentence "the cat meowed and the dog barked." More aspects of adult grammar are learned at school and later in life. Some children have a complex, structurally based grammatical system obeying many of the principles governing adult grammar, by the age of three or four (Brown, 1973; Goodluck, 1991; Wells, 1985).

Sign languages have their own grammar and syntax, which includes rules for the order of signs (Bonvillian, 1999; Brown, 1973; Frijn & De Haan, 1990; Gardner & Gardner, 1978; Klima & Bellugi, 1972; Neidle, Kegl, MacLaughlin, Bahan & Lee, 2000; Sandler & Lillo-Martin, 2001; Terrace, 1981, 1983; Terrace et al., 1979; Wallman, 1992). Thus, ASL grammar includes a subject-verb-object (SVO) sequencing of signs. It also has recursion and embedding of subordinate clauses (Sandler & Lillo-Martin, 2001). See also the summary of ASL and its characteristics in Chapter 1. In a study on deaf children who had constructed their own gestural communication systems, consistent sequences of signs to express semantic roles spontaneously emerged (Goldin-Meadow & Feldman, 1977; Goldin-Meadow & Mylander, 1984).

Order in the signing chimpanzees' combinations.

The Gardners published several preferences for sign order that were found to exist in the combinations of the cross-fostered chimpanzees. Their interpretation of these spontaneous

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sometimes happen to emit some interesting-looking strings.

preferences was at first a cautious one. Later they saw these regularities in order as evidence for grammatical structure. This evolution in thought will be discussed with some detail now.

When in 1971 they discussed the nature of the combinations that Washoe made, the Gardners tried to explain how she came to make seemingly grammatically structured utterances, such as YOU TICKLE ME WASHOE or YOU PEEKABOO ME. They said that such sequences could be explained semantically, and there was no need to infer syntax. In the case of humans that appeared to apply the English rule of 'subject-verb-object' order in all kinds of utterances, it was justified to explain this pattern in terms of a syntactical rule. However, with "immature primates whose utterances are brief, simple, and relatively homogeneous in content" (p. 176),[100] a semantic rather than a syntactical rule sufficed. They explained such a semantic pattern with the following example. Washoe had learned the difference in reference between IN and OUT by noticing the difference in the context when each sign was used. Similarly then, she could have understood the different meaning of ME TICKLE YOU and YOU TICKLE ME by taking into account the context. There was thus no necessity to infer a grammatical rule such as subject-verb-object.

In connection to this, they provided highly significant information about the use of "pronouns" and proper names in Washoe's combinations. They mentioned that the humans always interpreted Washoe's utterances with the sign TICKLE as requests by her to be tickled, rather than as announcements that she was going to tickle them. It did not really matter what exactly it was that Washoe signed, whether this was YOU TICKLE ME WASHOE, TICKLE ME WASHOE ROGER or ME TICKLE. The Gardners then asked themselves why Washoe added ME and YOU and name signs to her TICKLE utterances at all. They dismissed an explanation that suggests the emergence of syntax and offered simpler explanations. One was that this use of pronouns and names might have been the result of simple imitation. Because the humans continuously used proper names and pronouns in their

utterances, and especially in utterances that involved activities between Washoe and them, Washoe might have started to use these same signs as an imitation.

Another significant remark was that the humans might well have complied more readily with her tickle requests when she added the proper names and pronouns. Adding name signs to requests might thus simply have functioned to add strength to a request by using a human-pleasing or -manipulating sign.[101]

Further relevant information with regards to "pronoun" use, was that Washoe often combined YOU and ME in an apparent routine fashion. In 90% of combinations of YOU, ME, and an action sign, YOU ME appeared before the action sign, as in YOU ME OUT and YOU ME GO. Also, in 90% of combinations with YOU and ME, YOU preceded ME, as in YOU ME OUT.[102] Only later did the YOU-action-ME format become more prominent. With regards to these last two regularities of 90%, the Gardners also rejected an interpretation by reference to syntactic rules. Again, imitation was mentioned as a simpler explanation. The humans had these same preferred orders between the two pronouns. The Gardners explained that Washoe might not necessarily have been copying exact particular combinations, but just the general aspects of the human signing in this respect.

They then continued by arguing that even if one were to reject imitation as an explanation for Washoe's preferences, the orders might have been semantically originated,

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[100] Later in this chapter, in section 2.2.5. on multiple-sign utterances, it will be shown that Terrace concluded that Nim's multi-sign utterances of different lengths showed homogeneity in the form of an enormous overlap in topic.

[101] The linguist McNeill (1974) was one of the people the Gardners sent regular unpublished summaries of Project Washoe to. Interestingly, McNeill says that in one of these summaries it was mentioned that the sign ROGER originally meant "please." In the beginning then, some human name signs may have been almost comparable to request markers.

[102] McNeill (1974) suggests an interesting mechanical explanation for this particular preference. He says that producing an utterance of the type YOU-ME-action is mechanically easier to make. This is because it starts with pointing to the addressee (YOU), followed by moving the same index to one's own chest (ME), which is the part of the signing space where an action sign is usually also made.

McNeill's analysis of Washoe's combinations of signs has further alternative explanations to a linguistic interpretation. For example, he points out that Washoe did not so much encode the roles of agents and recipients in the strings that showed preferential orders, but rather formed these sequences on the unusual basis of who was the addressee and who the non-addressee in the situation (the non-addressee always being herself, ME, WASHOE). His conclusion is that "Washoe apparently does not use word combinations in a way that encodes conceptual relationships. The order of signs in strings, for example, was based on the social relations of addressee and non-addressee, rather than, as in the case of children, on the physicalistic notions of agent and

because in all cases it was just a combination of YOU, ME and an action sign. An order that was used for one action sign, as in YOU TICKLE ME, could have been used with other action signs as well (as in YOU OUT ME) "based on the semantic similarity between the two" action signs. They concluded their 1971 discussion of order preferences by stating that they were not "forced" to interpret the nonrandom features of Washoe's combinations as evidence for syntax:

> For roughly the same reasons, it may be as misleading to describe nonrandom aspects of the utterances of immature primates in terms of syntax, as it is misleading to refer to nonrandom aspects of the running of rats in mazes in terms of hypotheses. (p. 178)

In 1978, however, the Gardners have changed their opinion quite considerably. Now they said that children and chimpanzees were similar in their (albeit limited) use of word order: "Neither the children nor the chimpanzees are rigorously precise or even narrowly consistent in their use of word order or any other grammatical device" (p. 55).[103] They then presented new preferences for order in Washoe's utterances, which were now considered to be evidence for grammatical use of order. One new order given was that Washoe used human names and YOU in sentence initial position (in 87 out of 96 combinations) and WASHOE or ME in only 53 out of 158 combinations in initial position. Basing themselves on the context of Washoe's utterances, they interpreted this preference as Washoe referring to herself as object and therefore not placed in first position, while others were considered as agents and therefore put in initial position.[104]

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recipient of an action." He adds, significantly, that "this is true despite evidence that the relations of agent, action, and recipient are intellectually within Washoe's grasp" (p. 84).

[103] In 1971, as in 1994a, the Gardners criticized earlier claims by linguists such as Roger Brown on the early presence of word order in child utterances. Saying that these linguists portrayed human children as being more precise in their speech than college professors, the Gardners were of the opinion that it was only because of the use of the fallible method of rich interpretation that linguists have interpreted any utterance of a child as fitting in one way or another into grammatical rules for order. See also section 3.4. on semantic relations for a further presentation of this criticism.

[104] Note that the Gardners' 1971 remark on the lack of necessity to explain nonrandom features of combinations as evidence for syntax, can equally well be applied to this preference. Also, it is remarkable that in 1978 the

The other new order rule that was considered evidence for grammatical use was Washoe's use of the pointing index, the sign for THAT/THERE. When Washoe was spontaneously naming pictures or objects or had just been asked WHAT THAT?, she put THAT/THERE in sentence initial position in 34 utterances out of a sample of 35.[105] In contrast, in response to WHERE questions she used THAT/THERE in sentence final position in 20 out of 26 constructions.[106] They later found the exact same preference for Moja, Tatu and Dar. They too, mostly put THAT/THERE in initial position in demonstrative phrases, and in final position in locative ones (1994a).

A last order found in the chimpanzee utterances was that Moja, Tatu and Dar, significantly placed signs for traits and attributes more frequently before signs for persons and objects, rather than after these (1994a). Examples of this preferential order were: GOOD DAR, QUIET ME, BLACK DOG, and MINE HAT.

Roger Fouts has been quite strong in his claims that the combinations made by the chimpanzees followed grammatical rules (1978a, 1983b, 1997; Fouts & Budd, 1979; Fouts & Rigby, 1977; Gorcyca, Garner & Fouts, 1982). In great contrast to the Gardners' scepticism of 1971, he referred to the routines mentioned there of Washoe's combinations and interpreted them to be evidence of syntax.[107] He said: "If Washoe's signing didn't have rules, then she would have combined signs randomly, but 90 percent of the time, her subject

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Gardners did not discuss the influence of imitation in the generation of such preferences. McNeill's remark on encoding (non)addressees only, also does not get discussed.

[105] In an analysis of the comprehensive samples of Washoe's sign use it was also found that in 19 of 20 two-sign combinations THAT appeared in initial position when naming pictures in a magazine (Gardner & Gardner, 1974a).

[106] Though this pattern may be more a semantical habit than a syntactical rule (again think of their 1971 remark), again, the role of imitation is not addressed. The examples given, however, all show imitation in process: "Q. *Where cow?* A. *Cow there*, and Q. *Where tickle?* A. *Tickle there*" (p. 56). Notice that what Washoe does here is first imitate the last sign of the human question and then add the THERE sign. So there may have been a pattern where the first sign of her utterance was an imitated sign from the human. Which would then result in giving answers with THAT in sentence initial position in reply to the WHAT THAT? questions (THAT and THERE are actually the same sign, the only difference being that with THAT the index points to some object nearby, whereas with THERE the index points to something at a further distance). It is not said that this is the real explanation for the found regularity in Washoe's utterances. However, it is questionable that the Gardners did not look at factors such as imitation in these cases, especially because only several years before they had acknowledged its importance in many ways.

[107] Indeed, Fouts and Rigby (1977) said that despite the Gardners' explanation of imitation: "from a behavioral viewpoint, however, there appears to be little difference between Washoe's preferences in word order and language behavior in human children in learning syntax" (p. 1044).

preceded her verbs, as in YOU ME OUT, YOU ME GO" (1997, p. 102).[108] He continued by saying that Washoe: "also understood how to use the subject and object. When I signed ME TICKLE YOU, she would get ready to be tickled. But when I signed YOU TICKLE ME, she would tickle back" (p. 102). The ample opportunity for nonverbal cues from the context, by which Washoe could understand in what sense the tickle game should be played, was not mentioned though.

Fouts further demonstrated that the chimpanzees "seemed to follow rules of syntax" by giving an anecdotal example: "[Washoe] once pestered me to let her try a cigarette I was smoking: GIVE ME SMOKE, SMOKE WASHOE, HURRY GIVE SMOKE. Finally I signed ASK POLITELY. She responded PLEASE GIVE ME THAT HOT SMOKE" (p. 102-103).

Fouts also carried out a study with the Oklahoma chimpanzee Ally in which he was taught to use a specific sign order in three-sign utterances (Fouts, 1978a, 1997; Fouts & Couch, 1976; Fouts & Mellgren, 1976). The goal was to have Ally make sign utterances that were ordered along the pattern of subject-preposition-location. The signs ON, IN and UNDER were used as prepositions. By making heavy use of rewards, Ally was taught to produce utterances such as BALL IN BOX. A situation was then set up where objects were arranged in different positions and Ally was asked WHERE X? questions. In response, in 50% of his productions, Ally made a correct string of subject, preposition and location. However, he often left out the subject in his productions, only making an actual three-sign utterance in 44 of the 240 trials. Errors were made in the subject, preposition and location of the utterances, but he never made an error in the learned sign order. According to Fouts, this study demonstrated that a chimpanzee "can master a simple syntactical system" (1978a, p.

[108] It was mentioned on the previous page that the Gardners interpreted this preference to mean that Washoe had simply imitated the humans. Furthermore, in the discussion above it has been shown that the only alternative to random ordering does not need to be the presupposition of syntactic rules. Semantic rules of some sort may have accounted for the found preferences. Also, the way Fouts phrases this sentence, Washoe's subject preceding her verbs, is suggesting more than actually happened: Washoe only had this preference with the signs YOU and ME and not with all subjects.

123). In 1997 Fouts said that Ally somehow had learned a grammatical rule, and then used this finding as evidence against Chomsky's position of an innate grammatical device.[109]

Turning now to the opinion of the Nim team, Terrace et al. (1979) mentioned that Nim's teachers often combined their signs in a stereotypical order on the basis of English word order, thus giving Nim a model to copy. In addition, they may well have provoked the use of certain orders in Nim by praising him for well-formed combinations. Only the presence of preferential orders where each of the signs within the combinations was represented by a large variety of different signs, might have justified a conclusion that a grammatical rule was present. Regularities should have been present in the combining of semantic classes of signs rather than of unique, individual lexical items (Seidenberg & Petitto, 1979).[110]

Terrace and his team analyzed 11,845 two-sign combinations from the teachers' reports for possible preferences in order, or distributional regularities (Terrace, 1979a, 1981, 1983; Terrace et al.,1979, 1980). They found the following pattern. The signs MORE, GIVE and transitive verb signs (such as BITE, BRUSH, HUG, KISS and TICKLE), were more frequent in the initial than in the final position of a combination with another sign. The signs ME and NIM were most often placed in the final position of a combination.[111] From what they knew of the human sign input before the systematic video analyses were done, part of these regularities might be explainable by imitation. The humans also generally used MORE in sentence initial position. However, this was not the case with combinations with the verb signs. Nim started making combinations in the form of GIVE + X long before the humans asked him to give objects and thus supplied him with such sentences as a model. Nevertheless, Terrace and his colleagues consider the assumption that such preferences were evidence for grammatical rules as not really warranted. They might only be particular

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[109] Fouts & Couch (1976) worded it somewhat more modestly: "[Ally's] system could not legitimately be called formally complex, but it did incorporate all of the essential aspects of language in rudimentary form" (p. 155).
[110] See also Braine's (1976) clarifying discussion of productive positional patterns in combinations.

idiosyncratic habits, possibly evolved from the continuous routines in specific situations such as play and mealtimes. Statistical analyses were subsequently made to see whether such independent position habits could predict the frequency of occurrence of certain types of combinations. The results showed that, notwithstanding the preferences that were found, real evidence for position habits could not be determined. Terrace et al. (1980) concluded that they do not really know what the found frequency patterns in effect mean.

Seidenberg & Petitto (1981) provided further important information on the found preferences for certain order. They showed that for all these preferences, a very small number of types accounted for a high proportion of the tokens in each order. Thus, 44% of the GIVE+X tokens were accounted for by only three signs combined with GIVE: GIVE EAT, GIVE ME and GIVE NIM. In a similar fashion, 54% of combinations of MORE+X consisted of MORE EAT, MORE DRINK and MORE TICKLE.

Just as the Terrace team withdrew their conclusions on the presence of semantic relations after the discourse analysis of videotapes had shown the dominant role of imitation, they also considered it unwarranted to make claims on sign order. As the exact role of imitation could not be determined in the unfilmed combinations used in the corpus for their structural analysis, the found preferences for order in these combinations could not be further assessed.

2.4.2. ASL inflectional devices.

In sign languages across the world, grammar is not only present in the form of certain rules for sign order. The meaning of signs and sequences of signs can be modified by several forms of what are called sign inflections (Bonvillian, 1999; Gardner & Gardner, 1978, 1989a, 1989d, 1994a; Fouts, 1987, 1997; Rimpau, Gardner & Gardner, 1989; Van Cantfort & Rimpau, 1982). In all of these the original citation form of a sign is changed in order to

[111] Seidenberg (1986) mentions that these might be "stereotypic combinations ... produced in a rote, mechanized fashion" (p. 35).

produce a change in the semantic, pragmatic or grammatical field. Some of the following inflection techniques exist in ASL:

- Making a sign that can be done with only one hand, by producing it with two hands. This increases the emphasis or intensity of the sign's meaning. Signing LIKE with two hands can mean that one likes something very much. It can also be used to refer to a bigger version of the single hand sign's meaning. Thus, signing EAT with both hands can refer to a banquet or a big meal.
- Reiteration of a sign can change the meaning of a sign altogether. For example, repeatedly signing HOUSE turns into a sign for TOWN, reiterated TREEs can stand for FOREST, and so on. Besides this function, reiteration can also indicate assent or emphasis.
- Establishment of loci: Changing the place where one makes a sign expresses a change in meaning. Placing an action sign on oneself can mean that oneself is the agent to carry out the action. Placing the sign on someone else means that that other person should carry out the action. One can also just move an action sign toward an intended agent along with the line of sight in the signing space, rather than actually making the sign on the body of that person.

In the Gardners' field records on the signing chimpanzees it was reported that they made seemingly similar sign modifications by departing from the citation form (Gardner & Gardner, 1978; Rimpau et al., 1989). Reiteration took place, as when Tatu signed ICECREAM ICECREAM ICECREAM ICECREAM ICECREAM ICECREAM in response to a human announcing that she was going to get ice cream (Drumm et al., 1986; Gardner, Gardner & Drumm, 1989). The chimpanzees also made very large signs, or they made them more vigorously or emphatically. There were also instances of the establishment of loci. For example, the place of the sign HURT was modified to indicate various cuts and bruises, and made on the head, if the chimpanzee had just fallen. They also placed signs on the body of the human, as happened with SWALLOW and TICKLE. The Gardners (1978) claimed that the chimpanzees indicated the agent of the action with these place modifications. They

analyzed the context in which these inflections occurred, and found that making the sign on the human meant that the human was the agent (indicating [YOU] TICKLE or [YOU BE] QUIET), while signing on themselves was to refer to themselves as agent ([I] TICKLE or [I BE] QUIET). Wallman (1992) retorted to this claim that there was no documentation of the contexts in which these behaviours occurred and the claim was therefore at best only suggestive.

A systematic study on sign inflection was carried out by James Rimpau (who had collaborated with the Gardners on their second project) together with the Gardners (1989). They looked in particular at the use of place modification by the chimpanzees. They analyzed videotaped sessions of interaction between Dar and a human caretaker, Tony McCorkle. The interaction sessions varied in length from 7 to 25 minutes, spanning a total of 105 minutes altogether. The videos were made somewhere between November 1979 (when Dar was 40 months old) and August 1980 (when Dar was 49 months of age). Of the 1,531 times Dar made a sign in these minutes (most of which were in response to a human question), 151 were modified for place. Especially action and object signs were thus modified, with the following signs as the most modified (in brackets the number of times it was modified): TICKLE (27), BRUSH (25), GUM (17), and GROOM (16). Rimpau et al. then analyzed whether Dar was indicating the pronoun YOU when he made a sign on the human's body, and whether he was indicating the locative THERE when he placed the sign somewhere else on his own body other than the original citation place. They analyzed this by looking at Dar's responses to 72 Wh-questions from the human. If Dar responded by signing on the addressee when asked a WHO or WHOSE question, then this would suggest he indicated YOU. Should he respond by a place modification on his own body when asked a WHERE question, than that behaviour indicated that Dar meant THERE by the sign modification. The results were in agreement with these expectations. Two thirds of the times that Dar made a sign modification on his body (8 out of 12) were in response to a WHERE question. Place modifications by

making the sign on the human addressee's body occurred in two thirds of Dar's responses to a WHO or WHOSE question. The conclusion by Rimpau et al. was that Dar's action sign modifications were "systematic and express distinctions in meaning" (p. 262). "Dar used this device to incorporate reference to person, place and instrument" (p. 260). (See chapter 3.4. for a discussion of the problems of this study.)

Seidenberg and Petitto (1979) have criticized the supposed ASL inflections in the apes' signing. They pointed out that though the chimpanzees repeat signs, this has none of the functions reiteration has in ASL, where semantic and grammatical rules specify its use. To explain the chimpanzees' use of repetition a simple strategy to get what they want can be the case. They may sign according to the motto: "more signing is better."

Without further information on these particular behaviours the evidence is not clear that chimpanzees use sign inflections in a manner common to ASL, or to human children acquiring a sign language.

2.5. Multiple-sign combinations.

When children start to make combinations of more than two words, they usually express more complex messages. For example, children will expand on the semantic relations expressed in their two-word combinations or combine several different relations. Two types of three word-utterances are the most common at an early stage (Brown, 1973): agent+action+object, as in "Daddy eats breakfast" or "Mommy eat cookie; and agent+action+location, for example "Mommy sleep chair." Notice how in "Daddy eats breakfast" two-word combinations like "eats breakfast" and "Daddy eats" have become combined in a longer combination. Expansion of semantic relations can take place in the form of expanding the attribution, possession or recurrence of an object term. For example, "eat cookie" can turn into "eat big cookie." Further on, the child will produce even longer utterances that include negative and interrogative sentence types, such as "Daddy didn't eat

breakfast" and "When will Daddy eat breakfast?" (Brown, 1973; Terrace, 1981; Tomasello & Brooks, 1999).

The Terrace team

According to Terrace, the chimpanzees' multiple-sign utterances of more than two signs cannot be considered informative elaborations of their two-sign combinations. Systematically analyzing 19,203 combinations from a corpus of Nim Chimpsky's utterances,[112] he compared Nim's 25 most frequent 2- and 3-sign combinations (Terrace, 1979a, 1981, 1983; Terrace et al., 1979, 1980). The result showed that there was a large overlap between these combinations.[113] 18 of Nim's 25 most frequent 2-sign combinations reappeared in his 25 most frequent 3-sign sequences, and almost in the same order. Reproduced here from 1979a (p. 212), are the five most frequent 2- and 3-sign combinations, with their frequency.

Table 2.4. Nim's five most frequent 2-sign and 3-sign combinations.

2-sign combinations	Frequency	3-sign combinations	Frequency
PLAY ME	375	PLAY ME NIM	81
ME NIM	328	EAT ME NIM	48
TICKLE ME	316	EAT NIM EAT	46
EAT NIM	302	TICKLE ME NIM	44
MORE EAT	287	GRAPE EAT NIM	37

The overlap in topic of 3-sign combinations with 2-sign combinations did not mean that shorter utterances were informationally elaborated upon in longer utterances. It suggested the employment of routine utterances that have turned out to be useful. This was in contrast to human children's combinations: "While children produce certain routine combinations, they are relatively infrequent. Nim's utterances, on the other hand, show a high frequency of routine combinations (e.g., play me, me Nim...)," (Terrace, 1981, p. 106).

[112] See section 3.2 for more information on the exact status of this and other corpora.
[113] In fact, even Nim's 25 most frequent single-sign utterances showed a considerable overlap with all of his multi-sign utterances (1981, 1983).

Further analysis showed that there were two main phenomena that characterized Nim's construction of longer utterances: repetition and redundancy. Nim enlarged short utterances by adding signs that were redundant in terms of the information they added. Consider, for example, Nim's most frequent 3-sign utterance above, PLAY ME NIM. Within this utterance both ME and NIM refer to Nim himself, so one of the signs can be considered a redundant addition. The utterance does not give new information. This particular form of redundancy, combining both ME and NIM, occurred in a remarkably large percentage, 16%, of the total of his 2,925 three-sign combinations (Terrace et al., 1980).

Repetition was another characteristic of Nim's longer combinations of signs. For example, Nim made utterances like EAT NIM EAT, TICKLE ME TICKLE, and NUT NIM NUT. Of the analyzed corpus of 3-sign combinations 20% contained the repetition of one sign (Terrace et al., 1980). Seidenberg & Petitto (1979) even speak of "superabundance of repetition" as characteristic of the signing apes' combinations. In human children, however, it is "a rare event" that they repeat a word or a sequence of words within their utterances (Terrace et al., 1979).

Terrace (1979a, 1981) also presented a table with Nim's 21 most frequent 4-sign combinations. These revealed the same picture. 15 of the 21 types showed repetition of one or two signs, as in BANANA ME EAT BANANA and EAT DRINK EAT DRINK. Within the total of 708 tokens of 4-sign combinations, repetition of one or two signs occurred in 379 instances, or in 54%. The NIM+ME redundancy also occurred frequently: in 17% of the total (Terrace et al., 1980). Lastly, data were presented on Nim's combinations of 5 or more signs in the corpus. These consisted of 309 utterances. Again, 37% of these showed the NIM+ME redundancy, and 54% contained repetition of one or more signs. Terrace et al. then calculated the total percentage of redundancy of information by adding up the combinations with repetition and those containing both NIM and ME. The result was a great increase in informational redundancy as the utterances grew longer, the opposite that has been reported

for children. The numbers were: 35% of 3-sign combinations, 71% of 4-sign combinations, and 91% of combinations of 5 signs or more.

The signs NIM and ME, together with several other signs (GIVE, HUG, MORE, PLAY, and YOU) were eventually interpreted by Terrace (1980, 1982a, 1983) to be "wild cards," that is, general purpose signs that are "of universal relevance," that is, always "appropriate," acceptable and pleasing to the humans (see also section 2.1.5.). They are therefore useful to add to object and action signs when uttering requests. Frequent employment of these wild cards can thus be expected. The most famous example of Nim's wild card strings or run-on sequences, is his 16-sign utterance GIVE ORANGE ME GIVE EAT ORANGE ME EAT ORANGE GIVE ME EAT ORANGE GIVE ME YOU.

Because of all these detailed data, Terrace interpreted Nim's multiple-sign utterances not as conveying new information, but rather as chaining signs in order to add emphasis (Terrace et al., 1979). In his 1981 description of Nim's longer utterances, Terrace concluded as follows: "When signing a combination, as opposed to signing a single sign, Nim appears to be running on with his hands. It appears that Nim learned that the more he signs the better his chances for obtaining what he wants" (p. 103).[114] So rather than anything like language having been acquired, the signing apes were making attempts to communicate demands in a nonconversational manner by meaninglessly stringing signs (Terrace, 1981, 1983). Seidenberg & Petitto (1979) have similarly suggested pragmatic strategies without meaningful expression of information when the signing apes combine signs, such as "More signing is better"(p.188), "Sign until the experimenter terminates the trial," or "In an eating situation, sign any from the class of signs including *eat, drink, more, banana, give, please, sweet, finish*" (p. 211).

[114] Terrace (1981, 1983) also made a discourse analysis of interactions with Ally and Booee and examined their longer combinations. He did so using four published transcripts of interactions that Lyn Miles had appended to her dissertation. Terrace found the exact same phenomena as he had found for Nim. The MLU in the four sessions were low, ranging from 1.63 to 2.25. Ally and Booee also showed run-on sequences and a considerable overlap between utterances.

In conclusion, Nim's utterances did not increase in semantic and syntactic complexity as they became longer. Indeed, Nim's general redundancy of information, characteristic of his multiple-sign utterances, can be seen as a major difference with human children's multiple-word utterances, which in sharp contrast, show an increase in informative elaboration (Terrace, 1979a, 1981, 1983; Terrace et al., 1979, 1980). In interpreting the combinations of signs, the conclusion of the Nim team is that the signing apes basically emit only 1-sign utterances to communicate what they want, and that their multi-sign utterances are meaningless strings in order to please the humans and obtain more readily the things that they want from the humans.

Gardners and Fouts.

The Gardners and Fouts were of an altogether different opinion. In 1971 the Gardners presented a discussion of Washoe's combinations of three or more signs, based on 245 different instances gathered from the field records between April 1967, and June 1969. Interestingly, and rather similar to Nim, about half of these multiple-sign combinations consisted of adding a request marker (called "appeal-sign" at that time) to shorter combinations, for example PLEASE TICKLE MORE, COME ROGER TICKLE and OUT OPEN PLEASE HURRY.[115] Nevertheless, the Gardners said that the remaining combinations all "introduced new information and new relations among signs" (p. 176). They specified that most of the added signs were proper names or pronouns. Also, "sometimes the effect was to specify more than one agent as in *you me in, you me out, you me Greg go*, and *Roger Washoe out*" (p. 176).[116]

[115] Two of these combinations show redundancy in the form of combining two request markers within the same utterance. Some of Washoe's longer combinations may have suffered of the same redundancy that Terrace reported for Nim's longer utterances (see also the next paragraph).

[116] It is remarkable that the adding of pronouns and name signs is one of the two major types of enlarging combinations of signs that was found. Especially because the Gardners mentioned in 1971 that adding names and 'pronouns' would be instrumentally useful for the chimpanzees to do, as it could result in the humans attending to their requests more quickly (as was discussed in section 2.4.1. on page 106). So rather than these combinations being examples of the chimpanzees wanting to express more information, it may just be the case

The Gardners further mentioned that there was also "name-pronoun redundancy, as in *you Naomi peekaboo* and *you tickle me Washoe*" (which, as was just discussed above, was a major characteristic of Nim's longer combinations). Other multiple-sign utterances were interpreted as a combination of more than one of the semantic relations, such as YOU ME DRINK GO and YOU ME OUT LOOK. These two instances were presented as a specification of not only an agent and an action, but in addition a destination or an object. Further longer combinations were apologies, that according to the Gardners specified not only an agent and an action but also an attribute, as in HUG ME GOOD. Another pattern in Washoe's early multiple-sign combinations specified, according to the Gardners, both the subject and the object of an action, such as ROGER WASHOE TICKLE, YOU TICKLE ME WASHOE, and YOU PEEKABOO ME (see also note 34). In 1989 Gardner et al. mentioned that the longer utterances could specify more than one agent of an action, specify agents, actions and locations, or specify agents, actions and objects of action.[117]

As for the presence of repetition of one or more signs within multiple-sign utterances, the Gardners and Fouts have mentioned that this occurred with their chimpanzee subjects as well (1971, 1994a; Drumm, Gardner & Gardner, 1986; Fouts, 1987 Gardner, Gardner & Drumm, 1989). They regarded the use of repetition as a pragmatic device with which to indicate emphasis or assent, as it is in the early language of human children. Details of the amount or manner in which repetition occurred were not given, though. This was because their transcription rules took out the repetitions of a sign within an utterance. They

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that, like Nim, they added these 'pronouns' and name signs as general purpose signs or wild cards, in order to exhort the humans to fulfill their requests.

[117] An intriguing remark was made in this publication when they described that the chimpanzees at first had no inhibition to string signs in a meaningless way: "At one time or another, each of the cross-fosterlings would attempt to answer questions with what seemed to the teacher to be a random string of related or unrelated signs, as if the pupil were guessing at the correct answer" (p. 82). Or rather than guessing, they may just have been trying to please the human by making as many signs as possible. The quoted remark is an admission by the Gardners that the chimpanzees used to string signs meaninglessly in the early days. They then said that they "discouraged" the making of these strings (still considered a guessing strategy), and did not count such strings as a correct answer to the human question, but as an error. They did not give further information on the particular ways in which these strings were discouraged. One imagines that the human question kept being repeated to the chimpanzees and would only stop being asked when the chimpanzee no longer made a long string of nonsense signs. This discouragement may have stopped the stringing of signs by the cross-fosterlings

disregarded immediate or successive repetitions of a sign, a rule which was also used by Terrace and colleagues (1979, 1980).[118] However, in contrast to Terrace, they also failed to indicate repetition of a sign when another, different sign was made in between. For example, in their transcriptions no distinction could be made anymore between the utterances GIMME FOOD and GIMME FOOD GIMME, because this last three-sign utterance would enter the records as the two-sign utterance GIMME FOOD.

In summary, the Gardners and Fouts considered the multiple-sign combinations that the chimpanzees made to be expressions of increased information. However, there were remarkable similarities with Nim's redundant and repetitive combinations in the reports on the Gardners' and Fouts' chimpanzees' sequences of signs.

Conclusion.

Soon after the chimpanzees in the different projects had acquired their first signs, they started to combine them in sequences of two or more signs. Terrace calculated the mean length of utterances (MLU) of his chimpanzee subject. He found that Nim's utterances did not increase in length. His MLU varied between 1.1 and 1.6 in the last 1.5 years of the project. Human children, though, show a steady increase over time. The Gardners and Fouts did not use the MLU measure because of methodological objections.

Two-sign combinations were analyzed for semantic structure in the form of semantic relations. This meant interpreting the chimpanzee sequences as patterns such as agent+action, object+action, attribute+object. The Gardners found that between 74 to 90 % of the chimpanzee utterances showed evidence of semantic relational structure. Terrace's team at first had also interpreted Nim's sequences to demonstrate semantic relations. However, Nim did not use a variety of signs in the different semantic roles. Also, systematic videoanalysis

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for a while. However, this success does not prove that their less string-like responses in this period showed a greater awareness of semantic structure than when they were stringing uninhibitedly.

showed that Nim imitated the humans to a considerable extent. They therefore dismissed all research that had not been based on permanent, filmed records. This included their earlier analysis of semantic structure. Thus, there was no evidence for semantic relations in Nim's utterances. He might simply have been imitating the humans.

Creative combinations also occurred, according to the Gardners and Fouts. These were instances where the chimpanzees creatively combined known signs in a novel way to describe objects and events they had not learned a sign for. The most famous instance was Washoe signing WATER BIRD for a swan. Terrace and his colleagues, however, warned that the chimpanzees might be combining in a more or less random manner or might have stringed signs that were relevant to the situation but individually unrelated to each other. Systematic analyses of the chimpanzee sequences had not been carried out. The humans might therefore only notice those combinations that made sense to the humans themselves and then unjustifiably ascribe creativity.

Syntactical structure in the form of position patterns of sign order was also claimed by the Gardners and Fouts. However, in their early publications the Gardners did not interpret the chimpanzee order preferences as a reflection of syntactical rules. Alternative explanations, such as semantic habits or imitation might account for the preferences. Nim showed several sign order regularities as well, but their nature was unclear. Also, after the video analyses, any conclusion by the Terrace team on this aspect was suspended, since it was unknown to what extent imitation might have played a part here as well. Modification of the signs' meaning by inflectional devices was also demonstrated, according to the Gardners. Reiteration was used for emphasis. Establishment of loci indicated the agent or the location of an action. Critics disagreed, the use of repetition was a chimpanzee strategy to obtain what they want.

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[118] The motivation for these rules was to insure the shortest possible description of a combination. Also, in multiple-sign utterances, immediately or successively repeated signs were not counted "to insure that we did not overestimate the length of Nim's utterances," (Terrace et al., 1980, p. 400).

There was also a substantial disagreement on the nature of multiple-sign combinations of three signs or more. Terrace and his colleagues found that Nim characteristically produced these by repeating signs (NIM EAT NIM), by adding redundant signs (adding NIM to a sequence with ME) or general purpose signs, also known as wild cards, that are always appropriate and pleasing to the humans (GIVE, HUG, MORE, PLAY, YOU). The Gardners and Fouts, however, claimed that their chimpanzees' longer combinations demonstrated an increase in informational content, though repetition and redundancy played a part in their chimpanzees' productions as well.

CHAPTER 2

THE RESULTS OF THE PROJECTS WITH SIGNING CHIMPANZEES

3. DISCOURSE AND CONVERSATIONAL SKILLS.

In this subchapter different discourse phenomena and conversational patterns will be described that were found to occur in the sign interactions between the chimpanzees and the humans. The first of these is the presence and extent of spontaneous signing. This refers to signing not preceded by human utterances or without imitation by the chimpanzee of human signs. Then the ability for turn-taking in the sign interactions will be discussed. The nature of interruption by the chimpanzee of the human will be analyzed. This will be followed by an extensive discussion of the role and nature of imitation by the chimpanzees. This section will be closed by a presentation of recent research on the conversation skills of the chimpanzees in Washington.

Spontaneous signing.

When they carried out the discourse analysis of Nim's videotapes, the Terrace team compared his signing behaviour with the developing language of children. They looked at the amount of utterances that were preceded by an adult or human utterance. These are called *adjacent* utterances. Utterances that are not preceded by an adult or human utterance are called *spontaneous* utterances. A study by Bloom, Rocissano and Hood (1976) showed that the percentage of adjacent utterances by children (at 21 months of age, with an MLU of 1.3) was 69.2 (with a range of 53 to 78%). In the videotaped corpus Nim's percentage was somewhat higher: 87 % (range of 58.7 to 90.9%) (Terrace et al., 1979). Thirteen percent of

the utterances in Nim's videotaped corpus must therefore have been spontaneous. In the last year of Project Nim only 10% of his utterances were spontaneous (Terrace, 1979a). According to Terrace and his colleagues, public films on apes in other sign projects (Washoe and Koko)[119] showed a similar pattern: most of their signing was in response to signing by their human interlocutors.[120] They also found that in these films ape utterances had been presented as spontaneous productions of linguistically correct sign use, when in fact these had been evoked by human initiation (such as a question) and contained imitated signs (Terrace et al., 1979, 1980, 1981). Eventually, Terrace (1985a) saw the nonspontaneous nature of the signing ape subjects as characteristic for ape sign use. In general, the apes' use of signs was more a reaction to the human evoking of signs, rather than a spontaneous employment of signs by themselves.

In contrast to Terrace, the Gardners and Fouts did not define spontaneous utterances as those that were not preceded by a human utterance. Instead, they defined the term in relation to the possibly imitated nature of the produced signs. As long as the signs in the utterance made by the chimpanzee were not made immediately before by a human, the utterance was considered to be spontaneous. The exact definition was that an utterance was spontaneous as long as there was no other prompting than repeated pointing at an object, asking questions such as WHAT IS IT? and WHAT DO YOU WANT?, or any other form of relatively uninformative questioning activity (Fouts, 1975a; B. Gardner, 1981, 1982a; Gardner & Gardner, 1971, 1975a; Gardner, Gardner & Nichols, 1989).[121] Percentages of

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[119] They analyzed two films on Washoe. One was a 1974 episode of the American science program *Nova* on the signing apes, entitled *The first signs of Washoe*. The other was a film produced by the Gardners in 1973, called *Teaching sign language to the chimpanzee: Washoe*, in which they showed a lot of sign interactions between Washoe, the Gardners and their co-workers. For Koko, the same *Nova* documentary used for Washoe, as well as a 1973 film made by Babette Schroeder, *Koko, A talking gorilla*, were examined.

[120] Terrace (1981) mentions that Patterson admits in her dissertation that the majority of Koko's utterances were not spontaneously produced, but elicited by the humans asking questions. Indeed, she says that this was characteristic: "My interactions with Koko were often characterized by frequent questions such as 'What's this?'" (Patterson, 1979, p. 153).

[121] The Gardners (1971) explained this particular definition as follows:

> Thus, if Washoe made the sign *cat* when she saw a cat through the window of a car while on an excursion, this was reported to be a spontaneous occurrence, whether or not it had been necessary to point out the cat to her or to ask her to name it. In the same vein, if Washoe made a *cat* sign when a picture of a cat was shown to her during a drill session, this was also

adjacent utterances to compare with those of Nim and human children are therefore not available for the chimpanzees in the Gardners' and Fouts' projects.

However, the Gardners and Fouts did provide information on the spontaneous initiation by the chimpanzees of signed interactions with the humans. Most of the times, the chimpanzees initiated a sign conversation (Gardner & Gardner, 1980). They specify that:

> after the first year, most of the signed exchanges between the chimpanzees and the human beings in the cross-fostering laboratory were initiated by the chimpanzees, themselves. Thousands upon thousands of incidents of signing appear in the records and in more than half, usually much more than half, of the incidents in any random sample, the signing was initiated by the chimpanzee. (Gardner et al., 1989, p. 63)

In 1992, they write with Van Cantfort that: "depending on the situation (e.g., free play, outings, mealtimes), the proportion of exchanges initiated by the chimpanzees ranged from a clear majority to nearly 100%" (p. 51). In a special study on the subject with Lucy, the chimpanzee initiated 77.9% of 267 conversations (Fouts, Shapiro & O'Neil, 1978). For Loulis a percentage of his spontaneous initiation has also been given: "The observation data indicate that 90+% of Loulis' signing is initiated by him. That is, when Loulis emits a sign, in the great majority of cases, there has been no spoken or signed verbal behavior preceding the sign" (Fouts, Hirsch & Fouts, 1982, p. 186). The Terrace team did not specify how many conversations were initiated by Nim himself. His percentage of 87 of nonspontaneous signing leaves little room for spontaneous initiation. Obviously the high percentages of initiation mentioned by the Gardners and Fouts are ruled out as a possibility for Nim.

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reported as a spontaneous occurrence if no informative guidance [modeling, pointing to the appropriate hand or body part, or moulding, *ER*] had been required. (p. 141)

Turn-taking and interruption.

The analyses of the videotaped interactions also showed that Nim had a higher rate of interruption when in conversation than human children. 71% of his utterances were simultaneously signed with the human. Of this overlap in utterance, 70% took place in the form of Nim starting an utterance while the human had not finished signing his or her utterance. Terrace et al. (1979) interpreted this to mean that Nim did not fully grasp the pragmatic rules of a conversation, such as turn-taking. He had not learned "the give-and-take aspect of conversation" (p. 900). Too much interruption frustrated exchange of information in a conversation, since both parties are communicating simultaneously rather than in succession (Terrace, 1979a, 1981, 1983; Terrace et al., 1980). Children on the other hand, appear to understand the rules of turn-taking and interrupt an adult with relatively low frequency (Pan & Snow, 1999; Terrace et al. 1979). Terrace described Nim's interruption behaviour as that "it appeared that he was more concerned about telling his teachers what he wanted of them than he was about what his teachers were saying to him or about exchanging information with them" (1979a, p. 219). What may also have played a part in his tendency to interrupt, was a possible strategy that the more rapidly he signed, the more rapidly his requests would be fulfilled. Again, according to Terrace and his colleagues the films on the apes in the other sign projects showed a similar pattern of frequent interruption of the humans.

The Gardners and Fouts strongly disagreed with this conclusion. They questioned the Terrace's team understanding of conversational turn-taking behaviour in ASL. This is because in sign language it is normal for overlap to occur. It is indeed normal turn-taking behaviour for the next person to start replying while the first person may still be repeating or holding the last sign of their utterance, which is exactly what Nim and the other apes did (Gardner & Gardner, 1980; O'Sullivan, Fouts, Hannum & Schneider, 1982; Van Cantfort & Rimpau, 1982).

Imitation.

The videotape analyses of Nim's interactions with his human companions enabled the following major important discovery. Nim's utterances were often full or partial imitations of the teacher's immediately preceding utterance (Terrace et al., 1979). In a full imitation, all the signs that the human interlocutor had just made were copied by Nim. A partial imitation, also called reduction, was an utterance where Nim did not imitate all of the human signs, but only some of them. Note that both these full and partial imitations only consisted of imitated signs, without adding nonimitated signs to them. Besides Nim imitating the complete signs made by his human teacher, his production of signs helped by human prompting was also considered to be an imitation. In the Nim team's definition, prompting meant that the teacher used only part of the proper configuration, movement or location of a sign that was appropriate in the context: "For example, the teacher might prompt *Nim* (first and second fingers drawn down the temple) by extending those two fingers from a fist" (Terrace et al., 1980, p. 377).

In percentages, Nim's utterances were full or partial imitations for 39.1% when he was 26 months old. This number increased to 54% by the time he was 44 months old (Terrace, 1981, 1983; Terrace et al., 1979, 1980). Comparing imitation in Nim's utterances with its presence in those of children, the difference was clear. The study on the discourse interaction between human children and adults by Bloom et al. (1976) was again taken as comparison material. In this study the children's utterances contained 18% of full and partial imitations (with a range of 12 to 23 %) when they were at an MLU between 1.19 and 1.41, or language Stage 1 as defined by Brown. As their MLU increased, the percentage of imitated utterances decreased. At the end of the period analyzed for the children, when they had an MLU between 3.70 and 4.23 (having entered Brown's Stage 5), the percentage of "imitations" and "reductions" had gone down to a meager 2 percent (with a range of 0 to 4).

It should be noted, though, that Terrace and his team did not compare the same comparanda and that therefore these percentages do not refer to the exact same phenomenon. For the human children the amount of imitation was calculated as a percentage of their total utterances. However, with Nim, the percentage referred to his adjacent utterances only, excluding spontaneous utterances that did not immediately follow a human utterance. Calculating imitation of the adjacent utterances only in the case of Nim and of the total number of utterances in the human children inflates Nim's frequency of imitation. This is because there is a greater opportunity for imitated utterances when only adjacent utterances are considered. Terrace should have either also given the percentage of imitation in the children's adjacent utterances, or the percentage of Nim's imitation of his total of utterances. O'Sullivan and Yeager (1989) drew attention to this unequal comparison and then calculated Nim's imitation anew, but now as a percentage of his total number of utterances. The result in fact made no big difference. Nim's percentage of imitation was only slightly lower. It was now 34% instead of 39%.

The author also calculated the percentage of imitative utterances as part of the adjacent utterances only, of the four children in the Bloom et al. study. This sometimes considerably increased the percentage. One of the children's percentages at Stage 1 was actually somewhat close to Nim's at 26 months. Kathryn imitated for 30.7 percent, compared to Nim's 39.1 percent. However, a drastic decrease of the imitation percentage as the children matured remained clearly present. The four children combined had the following rates of imitation as part of their adjacent utterances only: at Stage 1 this was 25.3% (range 16.9 to 30.7); at Stage 2 it had reduced to 10.2% (range 1.8 to 16.7); finally, at Stage 5 it had become 2.8% (range 0 to 5.4), which was almost the same as the percentage of the total utterances at

this time. Other studies on child language development have found a similar process of decline of imitation as children grow older (Bloom, Hood & Lightbown, 1974).[122]

Altogether then, despite Terrace's skewed comparison, the difference between Nim's rate of imitation and that of human children remains substantial. Nim clearly imitates a considerable amount more than the children.[123]

The humans in Project Nim had had no idea that the ape was imitating this much of their own signs. Nor had visiting expert observers, fluent in sign language, noticed the extent to which imitation played a part in the interaction between Nim and his human companions. Up until then, Terrace's team had been under the impression that Nim's signing was for the largest part a spontaneous phenomenon, and not just "simple imitation" (Terrace, 1981, 1983; Terrace et al, 1979, 1980). Indeed, Terrace said that since they were convinced that Nim was not imitating "precisely" everything that the human signed, less importance was given to

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[122] Nelson (1973) reports little imitation in the 50 children of her study, giving a median percentage of 2.75% of imitation when they were about 12 months old to 5.4% when they were at 24 months. Frijn and De Haan (1990) also mention that there is little imitation in general in children.

[123] Further analyses of the discourse revealed additional differences between Nim and human children. The amount and nature of expansion was examined. Expansions are utterances consisting of some of the words or signs the human or adult just made, combined with a few novel words or signs. 21.2 % of children's utterances at Stage 1 were expansions of adult utterances, increasing to 42% at Stage 5. Nim's expansions of his human companions' utterances were of a lower percentage. On average it was 7.3% (range of 1 to 15), which percentage remained "fairly constant" (Terrace, 1981, 1983; Terrace et al., 1979, 1980). Also, when children produced expansions, these usually were informative elaborations of the adult's utterance. Nim's expansions, on the other hand, did not show an increase in informational content, but rather consisted of adding general purpose signs that could be relevant in any context or situation. These were especially the wild card signs mentioned in sections 2.1.5. and 2.2.5. such as ME, NIM, YOU, HUG and EAT (Terrace et al., 1979, 1980).

Again, however, Terrace was not comparing the exact same phenomena here. The percentages he mentioned for the children concern what Bloom et al. called semantically (linguistically and contextually) contingent utterances. This included the children expanding on adult utterances (in stage 2 and 5 mostly by repeating the adult verb). Examples of child expansion were Peter saying "draw a boy" in response to the adult question "What did I draw?"; and Kathryn saying "doll shoes" upon the adult's "Let's take the shoes out." However, what are called expatiations and alternatives were also part of the children's contingent speech and therefore of the given percentages. In expatiations information is added and another related topic is introduced. An example was an adult saying "How did they get there?" about berries on trees, upon which Gia said "they just picked them up and put them on the hooks on the berries and they hang up them." Alternatives consisted of the child opposing the idea in the adult utterance (e.g., adult: "You gonna make a house again?", Peter saying: "tunnel") or choosing from more than one alternative presented in the adult utterance (as when an adult said "Did you call her a nurse? Or a stewardess", to which Kathryn responded with: "a stewardess." With Nim, however, Terrace only looked at expansions that included a sign from the human previous utterance, disregarding possible expatiations and alternatives.

Though Terrace muddled with the comparanda in the analysis, the nature of Nim's utterances still was clearly in contrast with the children. The children had high percentages of contingent speech with addition of new information, whereas Nim's expansions consisted of unspecific wild cards that did not increase the informational content.

record what the humans were signing, as to capture as much as possible about what Nim was signing.[124]

Furthermore, Terrace (1981) mentions that the normal method of data collection, observations by trained personnel without a permanent, filmed record, made it very difficult to get reliable material on both Nim's as well as the humans' signs in an interaction: "even if one wanted to record the teacher's signs, limitations of attention span would make it too difficult to remember all of the significant features of *both* the teacher's and Nim's signs" (p. 104). It was only after the painstaking analysis of the minute and detailed video records, carried out after the project was finished and Nim had been returned to Oklahoma, that the astonishing and important role of imitation showed up. Indeed, this was information that only the analysis of film or video data could have provided. Naturally, this unsuspected aspect of the sign interactions between the humans and Nim, had as its consequence that Terrace and his co-workers dismissed any earlier preliminary claims about the patterns and phenomena of Nim's signing behaviour that had been determined without the use of permanent film and video records (as was mentioned in the previous subchapters).

Richard Sanders (1985), one of Terrace's colleagues, analyzed 15 interaction sessions[125] and found that 35% of Nim's utterances contained imitation (full imitations and reductions). He analyzed in detail the particular utterance types that Nim produced by way of imitation, and compared these with children's imitative utterances. Children use imitation as an early learning strategy of language. They imitate their parents when they are learning new words or new semantic and syntactic structures. They rarely imitate words or structures, though, that they already have acquired (Bloom, Hood & Lightbown, 1974). No evidence for a similar pattern was found in the imitations that Nim showed. There was no significant

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[124] This attitude described here by Terrace has probably been characteristic of the other projects as well. Because the signing of the apes did not appear to consist solely of signs that were all imitated from the humans, it can be expected that the human side of the interactions was in a sense somewhat neglected. The signing behaviour of the apes was something so new and exciting in itself, and the success of teaching them signs so promising, that one can easily imagine that the earliest focus was to some extent limited to the sign production of the apes only.

[125] Nine of which had been the basis for the Terrace et al. 1979 video analysis.

difference in the types of utterances that were imitated and those that were made spontaneously. Sanders concluded that it appeared as if the main function of Nim's imitation was perhaps "acquisitive": to obtain objects or activities from the human.

Terrace's team went on to suggest that imitation might play an important role in the other projects as well, and, as in Project Nim, without anyone really being aware of this. This was their conclusion after examining the public films mentioned in footnote 119. Analysis of these publicly available ape utterances revealed frequent imitation by the apes.[126] Terrace (1985a, 1985b) later characterized the nature of all sign use of the apes as imitative.[127]

To the discourse data in the films on Washoe and Koko as pointed out by Terrace and colleagues, no attention had been drawn by the Gardners or Patterson. The Gardners discussed imitation for the first time in their 1971 publication. There it was mentioned that they found in their analysis of the comprehensive samples that Washoe was often repeating the whole or part of an utterance just made by her human companion. An example was a conversation where a human signed MY DRINK, to which Washoe reacted by signing DRINK. Though there are no further details in this publication,[128] it is at least clear from this

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[126] Analyzing the 155 utterances that Washoe produced in the film *Teaching sign language to the chimpanzee Washoe* (the majority of which were 1-sign utterances: 120), Terrace and his team found that every combination made by Washoe (35 in total) was preceded by a similar utterance or a prompt from the human. With regard to Koko's utterances, they concluded that all of the signs that she made in the film had just been signed by a human.

When the Terrace team published these detailed film analyses, they had included several illustrations in their publications of multiple frames from the Gardners' film in order to show how imitation could have taken place. Subsequently, the Gardners threatened Terrace with a lawsuit against using their material without permission (Wallman, 1992).

[127] He has also compared the signing ape projects to a fictional story by Franz Kafka, "*A report to an academy*," originally written in German as "*Ein Bericht für eine Akademie*." It is about a chimpanzee who acquired human language. Writing the story in 1917, half a century before the projects with signing apes started, Kafka portrays a chimpanzee who produces words by imitating humans, and only because he wants a way out of his captive situation. Like Washoe he had been caught in Africa. His new life among humans gave him one overpowering feeling: "kein Ausweg" or "no way out." Terrace (1981, 1983, 1984) quotes the following relevant sentences from the Kafka story: "...there was no attraction for me in imitating human beings. I imitated them because I needed a way out, and for no other reason... And so I learned things, gentlemen. Ah, one learns when one needs a way out; one learns at all costs." Terrace named his contribution to the Clever Hans conference (see chapter 1) after Kafka "*A report to an Academy, 1980.*" The chimpanzee who was the narrator in Kafka's story reported to an Akademie der Wissenschaften (Academy of Sciences), while Terrace was reporting to the New York Academy of Sciences, who organized the conference.

[128] The Gardners only said that further attention in the analysis of the samples would examine which parts of a human utterance were repeated by Washoe. However, such an interesting analysis was not mentioned again in the future.

remark that imitation did take place in Washoe's production of utterances, and apparently was a process that occurred often.

In later publications (Drumm, Gardner & Gardner, 1986; Gardner, Gardner & Drumm, 1989; Gardner & Gardner, 1994a), the Gardners discussed the subject by preferring to use the term "incorporation" instead of the word "imitation." They then claimed that the cross-fostered chimpanzees used imitation (or incorporation) just like human children do. Drawing from studies of child language acquisition, they interpreted the presence of imitation/incorporation in the following way. It was not an indication that the sign behaviour was not linguistic in nature. It should instead be seen as an important and useful pragmatic device to indicate a positive response in the form of agreement, assent or emphasis. With children this is a functional, linguistic phenomenon, and in the exact same way it ought to be interpreted for the signing apes. The results of a study with Patrick Drumm, another of their co-workers, gave the Gardners further ammunition for this particular interpretation. In this study the kind of response was examined that the chimpanzees gave to positive and to negative events and to the announcement of these respective events (Drumm et al.,1986; Gardner et al.,1989). It was documented whether the chimpanzees reacted by signing and/or by use of their natural vocalizations and nonverbal behaviour. In the analysis of the results they were able to determine the presence of imitation. It appeared that the announcement of positive events resulted in frequent imitation of signs that were part of the announcement by the human. This result was interpreted as further evidence for the linguistic use of signs. This was because human children also indicated their positive response by the pragmatic employment of imitation.

However, if one relates this result to the functions of imitation that Terrace and Sanders reported for Nim, the frequency of imitation at the announcements of positive events does not need to be interpreted as a form of pragmatic control of language. Instead, a focus

on acquisitively manipulating and influencing the human to obtain the announced positive events, would be all that is necessary to explain the result found by the Gardners and Drumm.

As additional proof for the spontaneous and generally nonimitative nature of their chimpanzees' signing the Gardners and Fouts have referred to the creative combinations that the chimpanzees made, the signing of the chimpanzees amongst themselves, and their private signing. The creative combinations, presented in 2.2.3., were produced by the chimpanzees out of their own accord. The particular instances had not been produced by the humans before, so there was no human model for the chimpanzees to imitate. The sign communications by the chimpanzees amongst themselves, especially when this was recorded with the remote videocameras, also excluded prompting by the humans or imitation by the chimpanzees. This was because there were no humans present when the remotely controlled videocameras recorded the use of signs by the chimpanzees with each other (see also section 2.4.7.). The private signing of the chimpanzees also was evidence of spontaneous sign behaviour as in these instances too there generally were no humans present from which they could imitate signs. Again, this was especially the case in the samples that were collected by remote videocameras (see also 2.4.9.).

Criticisms of Project Nim.

Besides these remarks on the presence and role of imitation, the Gardners' and Fouts' reaction to the results of the video analyses by Terrace and his colleagues, has been to attack the methods, procedures and design of Project Nim (Fouts, 1983a, 1987, 1997; Fouts, Hirsch & Fouts, 1982; B. Gardner, 1981, 1982a, 1982b; Gardner & Gardner, 1988, 1989; Linden, 1986; Marx, 1980; O'Sullivan et al., 1982; Van Cantfort & Rimpau, 1982).[129] They felt that substantial differences could be pointed out between Terrace's project and their own. These differences could account for the conflicting findings on imitation and other sign phenomena

[129] For the reasons presented below, Allen Gardner eventually was reported to qualify Project Nim as "the shoddiest piece of work I have ever seen in this area," (Marx, 1980, p. 1330).

between Nim and the Gardners' chimpanzees.[130] Thus there were supposed to be substantial differences in the rearing and teaching conditions of Nim and those of the chimpanzees in the Gardners' projects. Nim had been taught signs by a constantly changing group of teachers, numbering over 60 during the whole course of the project. Washoe and the other chimpanzees, though, had had a stable social environment with predominantly the Gardners, and later the Fouts, as their cross-fostering "parents." The Gardners behaved towards their chimpanzees in a similar way as parents towards their children.

Thomas Van Cantfort and James Rimpau (1982) (who both worked on the Gardners' projects) explained the amount of imitation found in Project Nim by claiming that the environment in which Nim lived caused a greater focus on imitating signs. When Nim was in his classroom, the lack of stimuli in the situation left little opportunity for Nim to introduce new topics himself. Further manipulation and coercion by his human teachers (such as withholding a desirable object until Nim produced the correct sign for it) may have caused him to imitate. Thus, the non-linguistic way in which Nim communicated was considered to be a construct and failure of Project Nim.

Other criticisms by the Gardners were a characterization of Project Nim as "a rigorously operant version of Project Washoe," (1988, 1989a; see also Marx, 1980). They claimed that Nim's correct responses were always promptly rewarded, which then must have led to teaching Nim how to grab and to request, rather than to communicate: "The relentless application of extrinsic incentives evoked the extrinsic responses that stifled communication," (1988, p. 445).[131] Further points of criticism[132] were that there were too few humans who were fluent in ASL on Project Nim, that Nim was drilled in structured settings

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[130] Though the Gardners and Fouts did not give percentages or the numbers of imitated utterances for their chimpanzees, their general tendency in this particular discussion was that Nim imitated much more than their own chimpanzees.

[131] They concluded that "it can hardly be surprising that video tape records of .... training sessions showed Nim mainly imitating the trainer's signs and begging for treats most of the time."

[132] Linden (1986) claims that the defenders of ape language have not been "above hitting back below the belt," in their reaction to critics. For example, in a talk to the Smithsonian Institution, Roger Fouts

in a substantially different magnitude from Washoe and the other chimpanzees, and that the Terrace group used a "rubber ruler" in the comparison between children and chimpanzees.

Apart from clear errors of representation in these criticisms of Project Nim, Terrace (1981, 1983) has agreed that these main points of critique were valid, up to a point. He too felt that there had been too many teachers, who were not all fluent enough in ASL. However, he also points out that "most of the methodological inadequacies of Project Nim have been exaggerated, and in any event, [...] they are hardly unique to Project Nim" (1981, p. 106). For example, though there have been 60 teachers in total, Nim was mainly related to by a core group of eight teachers, including Terrace himself. Most of the other teachers were people that occasionally played and took care of Nim, rather than being an official, regular teacher. In the Gardners' projects many similar such assistants helped in the care of the chimpanzees.[133] However, this has not been acknowledged by them. Similarly, non-fluent ASL users were part of all the ape sign projects. Most humans used some form of pidgin sign language.[134] As for Project Nim being a rigorously operant version of Project Washoe, Terrace (1979a) and colleagues (1980; Sanders, 1985) have clearly provided information about the role of rewards in teaching Nim signs. In section 2.4.3. this will be discussed in detail. There it will be shown that Nim was not rewarded the whole time, but only on occasion, thus similar to the use of rewards by Gardners and Fouts.

Terrace (1981, 1982a, 1983, 1984) and colleagues (Seidenberg, 1982; Seidenberg & Petitto, 1981) also showed that some of the publications with criticisms on Project Nim contained "patently false claims," (1983, p. 34). This was especially the case with Beatrice Gardner's 1981 article in *Contemporary Psychology*. Seidenberg (1982), in reply, even calls her presentation of Project Nim in that journal a "pointless, prejudiced description" (p. 155).

> put such emphasis on the fact that Terrace is a lifelong bachelor that the word took on a sinister connotation. He then went on to say that without having raised children, Terrace did not have the basis in human experience for making judgments about ape abilities. (p. 51)

[133] Terrace (1983) has mentioned that Fouts, in a personal communication, gave an estimated number of 40.

[134] Terrace (1981) argued that this should not be too much of a concern, because an ape who would not have acquired ASL, but pidgin sign language (which is also a grammatically structured language), would have been equally impressive.

For example, for unclear reasons Beatrice Gardner distorted the definitions of "imitation" and "prompting" that Terrace had used (see also Ristau & Robbins, 1982). She also referred to Nim's classroom as a "cell," and wrongly stated that the videos of Nim were only made in the classroom. Terrace (1983) responded thus: "At best these reviews present facts stripped of their context; at worst they simply propagate misinformation" (p. 34).

Besides this attack on Project Nim, the Gardners and Fouts did not at the time present further detailed information on the amount of imitation or spontaneous utterances by their chimpanzees. Nor did they at first react to Terrace's findings by agreeing that videoanalyses were important to make, as these could show phenomena that were not determinable otherwise. Had they made their own analyses of videotaped corpora to determine the exact role that imitation played in their chimpanzees' communications, their rebuttal of Terrace and Project Nim might have been confirmed by empirical data.

Later, two additional studies on imitation were carried out. These focused on differences in setting as a possible explanation for the contrasting data on imitation between Terrace and the Gardners and Fouts. The first of these was a study by O'Sullivan and Yeager (1989).[135] Interestingly, the subject was Nim Chimpsky. The study took place in 1980 at the Institute for Primate Studies at the University of Oklahoma, where Nim had been returned after Terrace's project. Conversations were compared with a training/drill setting, though there were five conversation sessions of 16 minutes each and only one of 8 minutes of drill/training (which had to be terminated because of increasing irritation and volatility on the part of the participants). There was thus not a similar amount of data for each condition. In the training or drill session the human interlocutor removed items one at a time from a box of toys and clothes, and asked Nim to name them, "demanding Nim's attention by signing emphatically if he failed to respond" (p. 271). The conversation sessions, however, consisted of relaxed, unstructured interaction, playing with the human and with the objects in the box, to which Nim now had free access. The results of the study were that Nim had a percentage

of only 14% spontaneous utterances in the drill/training sample, compared to 60% in the conversation sessions. Imitations were twice as frequent in the drill session than in the conversation sessions (13.8 % compared to 6 %).

Inspired by the results of O'Sullivan and Yeager, the Fouts' graduate student Vicki Kennerud decided to pursue this issue further. In a pilot study she found similar results caused by a difference in setting (Kennerud, Raymond & Fouts, 1990). In 1992 she then videotaped interactions between the chimpanzees and the humans in the 'playroom' enclosure of the Psychology Building's third floor of Central Washington University. The analysis of her study was used for her thesis as part of her Master of Science Degree, which was titled *The effect of social context on the use of American Sign Language by five chimpanzees (Pan troglodytes)* (1993). The main purpose of this study was to compare the sign use of the chimpanzees in what were called "drills" and "conversations."

Drill sessions consisted of structured questions, asking the chimpanzees to identify a picture or an object by signing WHAT THAT? If the chimpanzee did not respond or responded incorrectly to three consecutive queries of WHAT THAT?, the human interlocutor identified the picture or object by signing THAT APPLE [or other appropriate sign] CAN YOU SIGN APPLE? If the chimpanzee did not respond or responded incorrectly to three consecutive queries of this new kind, the human proceeded to the next picture/object and so on. At a correct chimpanzee response, the human signed a confirming response of RIGHT, GOOD, or YOU SMART before proceeding to the next picture or object. In the conversation setting, the nature of the interaction was more relaxed and unstructured. Humans did not have to drill the chimpanzees and could communicate freely about anything and let this be intertwined with play and grooming.

Kennerud's hypothesis was that imitation would occur more in the drill setting and that spontaneous signing would be more frequent in the conversation setting. The results of her study showed that spontaneous utterances were more frequent in the conversational

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[135] Chris O'Sullivan had been one of Fouts' graduate students in Oklahoma.

sessions, but, unexpectedly, the percentage of imitated utterances was larger in the conversation sessions as well. See chapter 3.4. for a discussion of several problems of the O'Sullivan & Yeager and Kennerud studies.

Further studies on conversational skills.

In the 1990s two dissertation studies were carried out by two of the Gardners' students that looked at particular conversational skills. The first of these studies was carried out by Mark Bodamer. After having obtained his M.Sc. degree at Central Washington University with his analysis of the chimpanzees' private signing, Bodamer went to the Gardners in Reno as a Ph.D. student. For his dissertation study, he analyzed the Ellensburg chimpanzees' initiation and maintenance of conversations with himself. He finished his dissertation in 1998, called *Cross-fostered chimpanzee initiated sign interactions.* Its main outline and conclusions were published in an article with Allen Gardner in 2002.

All sessions in Bodamer's study started with himself sitting with his back to the chimpanzee. He only turned to face the chimpanzee when the chimpanzee made an attention getting sound. Then the conversation would take off. In each session, Bodamer's first two reactions to the chimpanzee's signing were structured. After these prescripted turns he could sign or react to the chimpanzees in whatever way he wanted. His first prescribed reaction or probe was to present the chimpanzee with the question WHAT? His second probe was one of four conditions. In the 'What?' condition he asked WHAT? another time. In the On Topic condition he asked a specific Wh-question. For example, if the chimpanzee had signed COFFEE DRINK, Bodamer would ask a question such as WHO COFFEE DRINK? In the Affirmative condition he would sign the affirmative. For example, if Washoe signed DRINK PLEASE GIMME THERE, Bodamer signed YES TIME DRINK COME WASHOE. In the Denial condition he signed the negative, using signs such as NO, SORRY and CAN'T, as in

NO MORE BANANA if a chimpanzee had signed BANANA. Mary Lee Jensvold's study (see below) was an expansion of this research, with different conditions.

Bodamer found that the chimpanzees made the following attention getting sounds to get him to turn around: bronx cheers, hand claps, lip smacking, or a noisy sign such as DIRTY or PERSON in combination with a mouth sound.

In response to his first prescripted WHAT? reaction, the chimpanzees made an utterance that contained some of the signs from their first utterance, but rarely did they repeat the exact same signs from their initial utterance. The same situation occurred in response to his second probe: the chimpanzees responded by using some but not all of the same signs of their previous utterance. In the On Topic condition the chimpanzees often reacted to the Wh-question by using some of the signs from Bodamer's question. For example, Bodamer signed WHAT BRUSH? and Moja answered by signing BRUSH COME THERE RED CLOTHES.

Interestingly, Bodamer recognized that the chimpanzees were "relatively insensitive to the signs of their interlocutor" (p. 53). Thus, he found that there was no difference in response between the Affirmative and Denial condition. The chimpanzees mostly just continued signing, "regardless of encouragement or discouragement in the signs of their human interlocutor" (p. 53). Summarizing his results, Bodamer says that the chimpanzees "were attentive to and responsive to the interlocutor. They used the signs of ASL conversationally" (p. 56).

Mary Lee Jensvold did her dissertation study with the chimpanzees by presenting them with different types of questions and then analyzed the appropriateness of their responses, or their contingency on the conversation partner's previous utterance. She wrote up her study in her dissertation of 1996: *Cross-fostered chimpanzee responses to questions.* In 2000 she published the study and its findings in an article together with Allen Gardner.

Bodamer had already analyzed whether the chimpanzees responded appropriately to four different conditions of human reaction to their signing. Jensvold expanded on this

research by analyzing whether the chimpanzees' utterances were contingent and dependent on three successive previous utterances by the human. Contingency in conversations between humans has been studied by presenting successive questions and analyzing the responses to these questions. Jensvold did the same with the chimpanzees and analyzed whether they responded appropriately to the human utterances.

In common with the Bodamer study, the human side was structured. In the Bodamer study the human's first two reactions to the chimpanzee's signing were preset, in Jensvold three sequential turns of the human were prescribed according to four conditions. Thus, each session started with the chimpanzee signing something, after which Jensvold presented three successive questions or other responses, all three belonging to one of the conditions. The four conditions were the following. In the On Topic condition, comparable to Bodamer's On Topic condition, Jensvold asked three wh-questions (such as WHO, WHERE, WHOSE) related to the chimpanzee's utterance and appropriate to the context of the interaction. The General condition (comparable to Bodamer's General condition) consisted of the following order of general questions, 1) a questioning facial expression, 2) the sign WHAT?, and 3) the signs I NOT UNDERSTAND or the one composite sign DON'T-UNDERSTAND . In the Can't condition (Bodamer's Denial condition) non-question negative probes were uttered, such as CAN'T, SORRY CAN'T or I MUST GO. Lastly, the Disruptive condition had three wh-questions unrelated to the chimpanzee's utterance and inappropriate to the context, thus serving to disrupt the conversation. Examples of these questions were: WHERE FUNNY BIRD?, WHERE ROGER? or WHOSE CAT? (for a further description, see section 4.2.1.3.3.).

Jensvold found that the chimpanzees reacted appropriately to her four different conditions. She even says that they responded similarly as "older children" (p. 40). Thus, in the On Topic condition they either responded by using signs from the human question (imitation or incorporation) or using some of these and adding new signs to them

(expansions). Jensvold interpreted this as topic maintenance. In the General condition the chimpanzees expanded on their own previous utterances. They responded less in the Can't and Disruptive conditions than in the General and On Topic conditions. Jensvold summarized her results as that the chimpanzees "responded contingently and appropriately to varying types of questions and statements" (p. 42), and that such responses are "essential ingredients for a conversation" (p. iii).

Based on the results of these studies Bodamer and Jensvold have drawn the conclusion that the signing chimpanzees have the status of a conversational partner (Bodamer & Gardner, 2002; Jensvold & Gardner, 2000). This designation is considered justified because the chimpanzees reacted with appropriate responses to the human probes in these studies, and because they appropriately initiated and maintained conversations with the humans. "The cross-fosterlings developed into conversational partners because interlocutors had always treated them as conversational partners" (Bodamer & Gardner, 2002, p. 22), and because sign language had been an integral part of their lives from their infancy onwards.

Conclusion.

Using videotaped interactions between Nim and his human caretakers, a discourse analysis could be made. This showed several unexpected phenomena. Most of the signing was initiated by the humans. Eighty-seven percent of Nim's utterances were adjacent, in that they were preceded by a human utterance, leaving only thirteen percent for spontaneous utterances. These numbers were somewhat higher than the percentages of children. The Gardners and Fouts used a different definition of spontaneity. Utterances following human questions such as WHAT THAT? were also considered spontaneous, as long as they did not contain imitated signs. They claimed that their chimpanzees signed spontaneously in the majority of cases. In terms of initiation of sign interactions, most of the times it were the Gardners' chimpanzees who initiated a conversation.

Nim had a much higher rate of interruption than human children. In 70% of his simultaneously signed utterances with a human, Nim started an utterance while the human had not finished signing his or her utterance. Terrace and his colleagues interpreted this to mean that Nim had not learned the pragmatic rules of a conversation, such as turn-taking. Instead, he appeared to be more focused on signing what he wanted from the humans rather than on receiving the information the humans tried to emit to him. The Gardners and Fouts disagreed with this interpretation and claimed that the interruption was instead a normal turn-taking behaviour in ASL.

The most important discovery of the video analyses by the Terrace team was that Nim imitated many of the signs that the human had just made. Nim's imitation consisted of 39 to 54% of his adjacent utterances. Despite mistakes by Terrace and colleagues in the comparisons of Nim's discourse with that of human children, it was clear that Nim imitated substantially more than children. This important role that imitation played was wholly unexpected and led Terrace and colleagues to unsubstantiate earlier claims based on unfilmed data. They also claimed that imitation occurred to a similar degree in the other signing ape projects. The Gardners acknowledged that imitation played a part in their chimpanzees' productions, though exact numbers or percentages have not been given. They interpreted it as a pragmatic, and therefore linguistic, device with which to indicate assent or emphasis. Together with the Fouts they criticized the methods and procedures of Project Nim as a way to explain the differences in imitation and other sign phenomena between the projects. Terrace and colleagues responded to these criticisms by argueing that methodological inadequacies had been exaggerated and, more importantly, were common to all the projects.

Later several studies were reported that focused on the role of the interactional setting in the amount of imitation and spontaneity in the chimpanzees' signing. Spontaneous signing was more frequent in a conversational setting. Imitation appeared to be more prevalent in a drill setting, though not unequivocally. Recently, two studies analyzed several conversational

skills of the CHCI chimpanzees. A study by Bodamer showed that the chimpanzees would normally not sign to the human's back. They initiated a conversation by attention getting sounds or noisy signs. They maintained the conversation by being attentive and responsive to the human interlocutor. A study by Jensvold demonstrated that chimpanzees responded appropriately and contingently to different types of human questions and statements.

CHAPTER 2

THE RESULTS OF THE PROJECTS WITH SIGNING CHIMPANZEES

4. COMMUNICATIVE INTENTIONS

Another central point of debate within the controversy on signing apes, has been the motivation and intentions underlying the apes' sign use. A useful concept with which to analyze this aspect of the chimpanzees' signing, is the concept of communicative intention. This section will start with a short description in 4.1. of (the research on) communicative intentions in human children's language development. In 4.2. several studies on the communicative intentions in the apes' use of signs will be discussed. The rest of the chapter will consist of a detailed representation of the debate between Terrace and the Gardners and Fouts on the particular intentions motivating the signing chimpanzees. Section 4.3. will present the opinion of Terrace and his colleagues in this respect. They eventually came to designate the apes' signing as "acquisitive" in nature. In their eyes, all the chimpanzees cared about when they were using their signs, was to acquire objects, actions, access to things, and other desired changes in the situation. In sections 4.4. and 4.5. the Gardners' conclusions on the chimpanzees' motivation will be presented. They claimed that their chimpanzees' sign behaviour was not limited to requesting objects and actions, but also included regular naming of objects and pictures, as well as commenting on events and asking questions. Section 4.6. through 4.8. will cover the claims that the Fouts made on this subject. They agreed with the

Gardners' conclusions but also added new intentions. Thus they argued that the chimpanzees used signs amongst themselves for social reasons that did not involve asking for food or objects. The chimpanzees also expressed their emotions and feelings in explicit terms by using their signs. They even used them to insult. Lastly, the private signing was considered further evidence for intentions that were beyond simple requests.

4.1. Concepts and research.

Communicative intentions are the reasons for which persons communicate, through language or by nonverbal means.[136] The word "intention" in this term has been defined by one of its main investigators, the American linguist John Dore, as "the deliberate pursuit of a goal by means of instrumental behaviors subordinated to that goal" (1975b, p. 36). A speaker or signer thus wants to obtain some communicative goal with every utterance that he or she utters. In this way one can say that each utterance has an underlying communicative intention that determines for which purpose the utterance is produced.[137]

The concept of communicative intentions has been inspired by the notion of speech acts in the philosophy of language, especially by the works of the British philosophers Austin, Grice, and Searle (Dore, 1974, 1975a). The Oxford philosopher John. L. Austin (1962) was the first who presented a systematic account of language use. He viewed utterances as acts, such as assertions, declarations, questions, commands, promises and expressions of emotion. He distinguished between the meaning and reference of an utterance

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[136] Different terms have been used for this phenomenon. The term communicative intention, or communicative intent, is most common, though (Bates, Benigni, Bretherton, Camaioni & Volterra, 1979; Carpenter, Mastergeorge & Coggins, 1983; Coggins & Carpenter, 1981; Coggins, Olswang & Guthrie, 1987; Dore, 1974, 1975a, 1975b, 1988; Roth & Davidge, 1985; Tomasello & Brooks, 1999; Wetherby & Rodriguez, 1992; Wetherby, Cain, Yonclas & Walker, 1988). Other terms have been: intent (Lund & Duchan, 1988), speech act (Dore, 1974; Searle, 1969, 1975), primitive speech act (Dore, 1974), illocutionary act (Austin, 1962; Bonvillian, 1993; Dore, 1975a; Fraser, 1975), communicative act (Ninio & Snow, 1996), communicative function (Chalkley, 1982; Coggins & Carpenter, 1981; Greenfield & Smith, 1976; Nicholas & Geers, 1997), pragmatic function (Halliday, 1975), and function (Wells, 1985). Some of these terms are synonyms for the same phenomenon. Sometimes different terms have been used to indicate a different level in the linguistic communication, but the differences also come about because of the different conceptual and philosophical backgrounds of the investigators and theorists in this field.

[137] The study of communicative intentions thus belongs to the pragmatics of language use and, with regards to sentences, concerns their use in order to convey more than just the semantic content of a sentence.

(called "locution"), the intention of the speaker in saying the utterance (called "illocutionary force"), and the effect one wants the utterance to have on the interlocutor (called "perlocution"). Another British philosopher, Herbert Paul Grice, made a distinction between what he called the speaker's or utterer's meaning and the linguistic or conventional meaning of an utterance. He argued that it is the communicative intention of a language user that determines what the implied meaning is of an utterance in a specific context (Grice,1989). The philosopher John Searle (1969, 1975) was a student of Austin's and elaborated on his work. He coined the term 'speech act,' which he considered the basic unit of linguistic communication, and includes making statements, giving commands, asking questions, making promises, and, more abstractly, referring and predicating. Speech acts are intended to change the beliefs and/or behaviour of other people, especially of one's interlocutors. According to Searle, a speech act has two components:

> a proposition (defined in terms of a predicating expressing taking one or more referring expressions) and an illocutionary force (which indicates how the utterance is to be taken). Whereas the proposition conveys the conceptual content of the utterance, the illocutionary force indicates whether the utterance counts as an assertion, promise, question or any number of other acts. (1969, p. 229).

This analysis of the speech act thus allows to distinguish between a referential and an intentional meaning of an utterance (Dore, 1975b).

Intentional communication.

Intentional communication is a necessary ability to express communicative intentions. Communication is considered intentional when the communicating individual has the intention or goal to communicate to someone else. The onset of intentional communication in human children begins at about the age of 9 months. Prior to this age, children certainly

communicate, as is evident from nonverbal behaviour such as reaching towards a desired object, and expressive behaviour such as crying. However, at about 8 or 9 months there is a shift in behaviour that suggests that they are aware of the fact that they are communicating to someone else. It is then that we can speak of intentional communication. This has been defined by Bates, Benigni, Bretherton, Camaioni, and Volterra (1979) as "signaling behavior in which the sender is aware a priori of the effect that a signal will have on his listener, and he persists in that behavior until the effect is obtained or failure is clearly indicated" (p. 36). The behaviours indicating intentional communication are (a) visual checking behaviour, that is, alternating eye contact between the goal of one's communication and the interlocutor or listener while emitting the signal; (b) checking feedback from the interlocutor, as evidenced by the use of augmentation, addition or substitution of signals until the goal of the communication has been reached (for example, repeating signals when the interlocutor does not respond to a request); and (c) "ritualization" of signals, in which behaviours are exaggerated or abbreviated and the child acquires the conventional communicative signals of a linguistic community, an example of which is clear-cut pointing behaviour (Bates et al., 1979). Notice that this description refers to the preverbal child. As soon as a child acquires its first words or signs, the use of these is considered to be intentionally communicative, except in private speech or signing (Chalkley, 1982).

Intentional communicative behaviour has also been found in nonhuman great apes. It has been demonstrated especially by visual checking behaviour. Apes alternate eye contact between the goal and the individual that is interacted with, looking back and forth between them (Gomez, 1990, 1991; Leavens, Hopkins & Bard, 1996; Plooij, 1978; Savage-Rumbaugh, 1984a; Savage-Rumbaugh & Sevcik, 1984; Whiten & Byrne, 1991). A recent study on the pointing behaviour of the signing chimpanzees Moja and Tatu also provided evidence for intentional communication (Krause & Fouts, 1997). The chimpanzees made use of attention-getting behaviours, pointed only after mutual eye gaze was established, and

alternated their eye gaze between a food source and a human interactor while they were pointing to the food. Another recent study of the signing chimpanzees (Shaw, 2001) documented eye gaze towards the human interlocutor in the seconds accompanying the signed utterance by the chimpanzees. Shaw also found that the chimpanzees shifted their gaze between the location and the human interlocutor when they were pointing. Checking the interlocutor's feedback also appears to be present in the signing chimpanzees. The Bodamer and Jensvold studies found that the chimpanzees repeated or changed their sign utterances when the human did not respond to their requests (Bodamer & Gardner, 2002; Jensvold & Gardner, 2000). Also, in the child studies on communicative intentions proximity, orientation, and eye gaze towards the interlocutor, are part of the operational definition for communicative behaviour that is intentional (Coggins & Carpenter, 1981; Wetherby & Rodriguez, 1992). These behaviours are included in the operational definition of chimpanzee signing (and human speech) that is not private in nature (Bodamer, 1987; Bodamer et al., 1994; Furrow, 1984).

Studies of communicative intentions in children.

Since the 1970s, studies have been done on communicative intentions in the early communication of human children and several different taxonomies of intentions have been set up.[138] Children express a growing number of various communicative intentions, through gestures, vocalizations and words, by the end of the first year, from about the age of 9 months. They request objects and actions, as well as information (as in asking a question). They label, name, and comment on objects or pictures. They talk about the locations, properties, attributes, and ownership of objects and other items.[139] They call and greet others.

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[138] Important studies are the following: Bates et al., 1979; Carpenter et al., 1983; Coggins & Carpenter, 1981; Coggins et al., 1987; Dale, 1980; Day, 1986; Dore, 1974, 1975a, 1975b, 1988; Halliday, 1975; Lund & Duchan, 1988; Nicholas & Geers, 1997; Ninio & Snow, 1996; Roth & Davidge, 1985; Wells, 1985; Wetherby & Rodriguez, 1992; Wetherby et al., 1988.

[139] Notice the similarity with the categories of semantic relations that were presented in 2.2.2. The difference between these two different phenomena is that semantic relations are expressed in the semantic or referential meaning of an utterance. With communicative intentions, however, the semantic meaning is not always

They protest against actions of parents and other caretakers.[140] As their language development progresses, children will express additional intentions in their utterances. Amongst others, the children make evaluations of situations, report their own internal states and attribute internal states to others, give explanations, predict future states of affairs, express rules, create fantasy role plays, and make jokes (Dore, 1975a).[141]

Roth & Davidge (1985) suggest that there is a universal set of communicative intentions in early language acquisition.[142] Dore (1975a) has similarly argued that it is unlikely that there is an infinite set of types of acts. Children do

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determining the particular intention. The concept of communicative intentions indeed allows to go beyond the referential meaning and look at underlying pragmatic reasons for which the utterance is produced. Recall here Searle's distinction between a proposition (the conceptual content of an utterance) and its illocutionary force (the intentional way in which an utterance is meant). As an example, a child may say "Daddy throw." Semantically, this expresses the relation of agent+action. The communicative intention of this utterance, however may vary. It may be naming (describing a situation), it may also be a request for action (so that daddy may throw something), and it may even be a request for information (asking whether daddy will throw or has thrown). In his study of children's first combinations Braine (1976) also made clear that there is a difference between the semantic meaning of an utterance and its, what he calls pragmatic purpose:

> While some of the children's positional patterns are specific to one of these purposes ..., many patterns can be used for more than one purpose... Thus, *more X* may either request or comment on recurrence; similarly, locatives and actor-action forms can sometimes request as well as describe. Thus, the data indicate that a particular aspect of meaning, namely, the purpose for which a child uses an utterance, may or may not be part of the semantic representation of a pattern. (p. 61-62)

[140] In an interesting study Carpenter et al., (1983) examined the development of communicative intentions in the gestures, vocalizations and words used by six American children that were followed from the age of 8 to 16 months. They found the following similar sequence of emergence in these children: 1. protesting; 2. request for action; 3. request for object; 4. comment on action; 5. comment on object; and 6. answering. Verbal examples of these intentions in an interaction between a mother and her child were presented in this article. A child stretching its hand and pointing toward a toy race car on a shelf out of reach, while saying "car," is an example of a Request for object. Request for action was expressed by the child saying "go" while pointing to the car's wind-up key, putting it in its mother's hand. The mother later put the car back on the shelf and opened a book to start reading with the child. The child then showed Protesting by knocking the book out of its mother's hand, starting to cry and saying "no no no."

[141] There is no clear-cut picture with regards to the general age at which these latter types of intentions start to appear in children's linguistic utterances. Dore set up these types for a study of children ranging in age from 34 to 39 months. However, the verbal expression of internal states, for example, is already present in most children late in their second year, developing rapidly in the third year (Bretherton & Beeghly, 1982; Bretherton et al., 1981, 1986; Brown & Dunn, 1991; Dunn, Bretherton & Munn, 1987; Dunn & Brown, 1991, 1994; Dunn, Brown & Beardsall, 1991; Ridgeway, Waters & Kuczaj, 1985; Shatz, Wellman & Silber, 1983; Wellman, 1991). In one study Bretherton & Beeghly (1982) found a mean number of internal state words of 7.8 at 20 months, which rose to 37.2 at 28 months.

Gordon Wells (1985) did a longitudinal study of the communicative intentions of children who were studied from the age of 15 months onwards. He called them Functions at an utterance level, which were then part of Inter-Personal Purposes at a sub-sequence level. The children in his study showed a sharp increase up to the age of 30 months in he Inter-Personal Purposes Control (requests, commands, suggestions, etc.) and Representational (ostension (labeling), statements, content questions, etc.) and a decrease of the Expressive (exclamations, expression of internal states). From 36 to 60 months Control declined slightly, while Representational continued to increase. At age four, Exchange of information and Controlling of action were the most important language purposes.

[142] They did a longitudinal study of three children, speaking American English, Danish and Serbo-Croatian respectively, from their entrance into the single-word stage (at ages 1:5 to 1:8) to acquisition of the two-word

> a limited number of general things when they speak: they give and receive information, get attention and get others to do things for them, express their beliefs and feelings, commit themselves to future acts, establish facts, create fantasies, and communicate humor. (p. 242)

Different taxonomies and methodologies exist in the literature to determine the exact communicative intentions in children's utterances. In general, the different taxonomies are in agreement on the types of communicative intentions that are present in children's communications. All researchers acknowledge that communicative intentions cannot be directly observed. Their determination therefore inevitably contains an element of subjective judgement. Nevertheless, all intentions have been extensively operationalized and include the five following useful indicators for the particular intention at hand: the semantic content of an utterance, the grammatical and prosodic aspects of the utterance, the accompanying nonverbal behaviour of the speaker/signer, the context in which the utterance is made, and finally, the accompanying behaviour (verbal and nonverbal) of the conversation partner. See the Method chapter, 4.2.7.2., for a more extensive presentation of these indicators.

4.2. Ape studies using terms and methodology of communicative intentions.

Before the debate on communicative intentions in the ape language controversy is presented, a few empirical studies will first be examined. These analyzed the signing apes' utterances in terms of communicative intentions by applying the methodology of the child studies. There have been only three studies that explicitly did so. Lyn Miles, who later went on to teach signs to the orangutan Chantek, did an analysis of Ally's "communicative acts" (again, a different term). Francine (Penny) Patterson and her colleagues did a study of Koko's early

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stage (at age 2). All children used the nine intentions of the taxonomy that was used to code their utterances: naming, attributes, comments, tense, requests, negatives, affirmations, attention, and greetings. Naming and Attributes were most predominant in all languages, comprising between 53 to 69% of all intentions. Requests was more variably prevalent: it took up 30% of the American English speaking child's utterances, with 11% for the Danish and 19% for the Serbo-Croatian speaking child. Roth and Davidge also looked at correlations with the children's MLU and found that Naming was the major intention at an MLU of 1.0. The predominance of this intention decreased, and Attributes and Affirmations increased with the progression of the MLU.

primitive speech acts. Finally, Richard Sanders analyzed Nim's nonimitative utterances for purpose or motive.

Miles (1976) videotaped ten 15-minute conversations between Ally and a human conversation partner during relaxed play contexts. She then classified Ally's signing into three separate categories: action requests, naming, and "other acts." Her emphasis on finding out the different proportions of these categories, was to find out whether the impression of some people that chimpanzees use signs solely to engage in naming objects and making requests, was accurate. Miles found that 84% of Ally's communicative acts were in fact action requests and naming. The remaining 16% consisted of other acts, which was defined as including the following: attention devices, internal reports, questions, descriptions of events, descriptions of properties, statements of possession, and statements concerning the attributes of others.

Miles further found that a third of Ally's utterances were a response to a Wh-question, to which he replied with a 91% of action requests and naming. She points out that the human conversation partner "usually asked Wh-questions such as 'Who?,' 'What's this?,' and 'What do you want?,' as a way to introduce new topics of conversation and induce Ally to converse" (p. 594). Miles says that these Wh-questions inflate the found number of action requests and naming, as these responses are the most appropriate to such questions. She then separated the unsolicited communicative acts initiated by Ally from acts solicited by a Wh-question from the human conversation partner. Ally produced more than four times as many acts other than action requests and namings in the unsolicited condition (13%, compared to 3% in the solicited condition), suggesting that solicited responses to Wh-questions do not characterize Ally's natural use of signs. Re-analyzing Ally's communications by excluding the solicited acts, Miles found that action requests and naming were still the largest categories and accounted for 77% of his utterances. 23% consisted of other acts.

Patterson, Tanner and Mayer (1988) used Dore's 1974 system of primitive speech acts (PSAs) to analyze the use of gestures, vocalizations and signs by the gorilla Koko. Data were taken from the Koko diary entries covering a period from mid-July 1972 (month 1 of Project Koko, age of Koko 1:0) through mid-June 1973 (month 11 of project, age 1:11). The data were analyzed to determine the development of PSAs as well as the proportional frequency of the PSA categories.

Koko used all the categories from the third month of the study onwards. Her earliest categories were request action, protest, call, and answer. Labeling and repeating were less frequent. Signs were more used to label, request action and practice, while vocalizations and other auditory methods (such as clapping) appeared more in calling, greeting and protesting.

Patterson et al. (1988) mentioned that in the ninth month a new category appeared that was not present in Dore's system. They called it "appeasement" and concerned apologies after wrongdoing or misbehaviour on the part of Koko, when punishment was imminent or already in force. Koko used SORRY and SORRY-PLEASE in these situations, probably to be forgiven or to stop the punishment. In the eleven month, Koko also used SORRY-PLEASE to protest actions she disliked, such as diapering.

Some of the examples of the PSAs expressed through Koko's signs were the following. Labeling occurred when Koko signed LISTEN upon seeing a bell, and COMB while she was playing with a comb. Requesting action happened when Koko signed THERE, pointing to her stomach when her human companion stopped brushing it. Other signs regularly occurring in the action request category were FOOD, DRINK and MORE. Calling was expressed as Koko signed COME when a human companion started for the door. HUG was considered a greeting when a human had entered Koko's nursery.

Richard Sanders (1985) coded Nim's utterances for what he called purpose or motive. He did this with Nim's 12 most frequent nonimitative utterance types from the videotaped corpus, consisting of 578 individual utterance tokens. The purpose of these utterances was

almost always to request: "Signs rarely occurred in utterances whose function was to name something. Only utterances containing the trainers' name signs were used frequently in this way, 76% of the time. These occurred during a single session in which Nim was asked to name pictures of his trainers" (p. 206). The same motivation or intention of requesting was considered to be underlying his use of imitated utterance types: imitating the human as a useful device to obtain what he wanted.[143]

4.3. Terrace on intentions: The acquisitive nature of chimpanzee signing.

Continuing now with the general debate on the apes' intentions, Terrace described the function of Nim and other apes' signing behaviour as a means to obtain objects, actions, changes in situations, and further things that the apes may desire (1980, 1981,1983, 1984, 1985a). They sign to request various incentives, in the form of "rewarding activities such as being tickled, chased, hugged, access to a pet cat, books, drawing materials and items of food and drink" (1981, p. 113). One might therefore characterize the signing behaviour of apes as being "acquisitive" in nature (1985a). Petitto and Seidenberg (1979) similarly concluded that the signing apes have not learned the linguistic functions of signs, but "rather the consequences of particular acts of signing. They know that forming certain signs will have immediate benefits (e.g., someone will give them food or a toy, take them to the bathroom or perform some other positively reinforcing act)" (p. 179).[144]

Sometimes, though, Nim and the other apes also simply named or labeled objects and pictures. Terrace et al. said that Nim "signed regularly about pictures of food and drink

[143] Sanders says that indeed the teaching setup of all the projects with signing apes fostered a focus on acquiring objects and actions: "In the typical training situation, the trainer would begin in control of some object that Nim would like to obtain, or the trainer would initiate an activity that Nim would like to have repeated. The trainer would ... make Nim's use of the sign instrumental in his obtaining these rewards" (p. 200). This particular teaching setup is also evident as part of the Gardners' and Fouts' training methods.

[144] Seidenberg (1986) summarizes the results of all the projects as being explainable by the apes having "merely learned the *instrumental function* of signing" (p. 42). He then phrases it like this: "In other words, [the ape] could develop rituals of varying complexity that produced the desired outcomes."

objects, with little apparent interest in obtaining these objects" (1980, p. 378).[145] However, he generally did so within the context of picture-labeling sessions, in which he did receive regular praise from the human teacher. Praise was given by the humans in the form of signing things like GOOD or CORRECT. And there were other "social reinforcers": smiles and hugs from the humans. Terrace explained that he did not want to teach Nim only simple food requests, but also desired to make him aware of the social importance of signing:

> I wanted Nim to learn to sign in order to please his teachers and not just to obtain food and drink rewards. Accordingly, I instructed Carol [Stewart, Nim's principal sign teacher at the beginning of the project] to use food or drink rewards only when teaching a sign related to those rewards. At other times I wanted Nim to become receptive to praise and other kinds of social rewards. (1979a, p. 52)[146]

It may therefore be that the instances of Nim naming objects and pictures just mentioned by Terrace and colleagues may have been extrinsically motivated. That would not be the same as having an intrinsic interest in using signs or language, as a way to draw attention to something and communicate information just "for the sake of it." This transmission of information from one individual to another is a self-reinforcing goal in language. Human children readily use their language just for the sake of it. They derive an intrinsic pleasure from the sheer act of naming. When they refer to objects or aspects of their environment, they do not always have an interest in obtaining the object or something else, but the act of naming or referring is an end in itself. A child will name things "simply to indicate that she or he knows that the object she or he is attending to has a name and also to communicate the fact that she or he has noticed that object," (Terrace, 1985a, p. 1016). Children have a sheer

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[145] Dick Sanders refers to similar behaviour: "There were also occasions when Nim would sign to a picture of a familiar object in a book or a poster with little apparent interest in actually obtaining such an object" (1985, p. 200).

[146] To clarify this procedure, Terrace and his colleagues (1980) specified that Nim was not necessarily rewarded with a piece of food or some drink every time he signed about these edibles. Sanders (1985) similarly said that Nim did not need to be reinforced on every occasion by providing him with a desired object or carrying out a desired action.

delight in "contemplating [an] object and sharing it perceptually with the parent" (p. 1022). For example, a child may see a red flower and spontaneously say "red" while pointing to the flower.[147] Premack (1990) mentions an example of a 13-month-old child who pointed excitedly at a goldfish in a bowl, calling out its name, "ef!" Testing whether this was some sort of a request, the bowl was offered to the child, who subsequently did not approach the fish.

Apes that have learned symbols with which to communicate, however, referred to objects for the sole purpose of obtaining them (as far as this was known). There was no evidence that apes want to communicate that they simply noticed an object or some feature of their environment. Their use of symbols was rather characterized by expressing demands for various incentives. Whatever referential skills apes have, they were used "in the service of some concrete end" (p.1023).[148] Seidenberg (1986) pointed out that the apes in the projects could have used the signs in many different ways, but "the fact that they use them instrumentally across a wide range of conditions may reflect a powerful generalization about

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[147] See also Bloom (1970), Bloom, Lightbown & Hood (1975), Bowerman (1973a), Chalkley (1982), and Wells (1985) for more examples and discussion.

[148] The linguist Steven Pinker (1994) summed up the chimpanzees' motivation for signing in the following way:

> What impresses one the most about chimpanzee signing is that fundamentally, deep down, chimps just don't "get it." They know that the trainers like them to sign and that signing often gets them what they want, but they never seem to feel in their bones what language is and how to use it. (p. 340)

Umiker-Sebeok & Sebeok (1980) stated that this different use of signs by apes was not surprising when one considered that apes live in "a radically different phenomenal world" ("Umwelt" in the terminology of the famous zoologist Von Uexküll (Von Uexküll & Kriszat, 1934)) from humans: "An ape is not interested in verbal art, or painting, or the like, but in "apely" objects and relations, in brief, signs that are functionally meaningful to its species preeminently." Apes in the language projects are thus primarily motivated by "social needs and food rewards." They conclude together with McNeill that "chimpanzees are simply not interested in what humans are concerned with" (p. 49). However, "placed in a totally manmade environment" as in the projects, the apes

> adapt themselves, somewhat reluctantly, by learning a number of arbitrary signifier-signified associations and by utilizing them in situations where trainers will accept no alternative type of response. They will follow certain elementary prescribed rules of play, in other words, but there is no indication that they are playing the same "game. (p. 51).

their behavior" (p. 44).[149] A major difference between the signing apes and language-using human children was thus a difference in communicative intentions.[150]

The only behaviour that did not immediately fit the "acquisitive" characterization, occurred when Nim was observed "to sign about pictures when looking at them on his own, without attempting to involve the teacher" (Terrace et al., 1980, p. 378). These were probably instances of private signing, of which the intentions of the chimpanzees remain unclear (as will be discussed later in section 2.4.9.).

Though Terrace was strongly convinced that the signing behaviour of the apes could be explained by an acquisitive motivation, he and his colleagues have said on several occasions that this may not reflect the great apes' full potential (Seidenberg & Petitto, 1979; Terrace, 1979a, 1981, 1983; Terrace et al., 1980). Their conclusion in 1980 was as follows: "We are, of course, aware that our results cannot be considered definitely negative concerning an ape's capacity to master the basic features of a natural human language" (p. 440). They pointed out that all projects with signing apes had had inevitable limitations and did not take place under optimal or ideal conditions for language to develop. One aspect of Project Nim that they considered to have been of particular influence on Nim's motivation was the large group of teachers and caretakers that came and went during the course of the

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[149] In an interesting attempt to relate the ape communications in the language projects to their naturally occurring communication, Sarah Stebbins (1983) makes the following remark: "I know of no field observations ... of behavior akin to asking questions and naming objects by apes. Communication does not seem to play that kind of epistemological role in their social life" (p. 89).

[150] Terrace (1981, 1983, 1985) has related the acquisitive motivation of the signing chimpanzees to the absence of grammatical rules or even semantic relations. He asked the well-apt question: "why should an ape be interested in learning rules about relationships between signs when it can express all it cares to express through individual signs?" (1981, p. 112). If the only function of an ape (or child)'s communication is to demand things, than even a highly structured system of demands would not require grammatical rules. Take for example a request for a red plum from a far tree as opposed to a green apple under a near brush. Even such more specific requests do not need grammatical communication, since they "could be dealt with by unordered demands, eye-gaze, pointing, facial expression, or some combination thereof or by the successive elimination of alternative incentives," (1985, p. 1026). However, if one's intention is to "communicate information about a relationship between one object or action and another, about some attribute of an object, or about past or future events," then "ungrammatical strings of words would not suffice - hence the functional value of syntax" (p. 1026).

Interestingly, Terrace (1985) also related the motivational difference towards naming to the nature of consciousness of apes and humans. Humans are able to name and refer to their internal states, whereas apes and other animals are not. This would then be caused by the motivational difference in naming or symbol-using. It is not then, that apes do not have internal states, or do not perceive these. They communicate their internal states in non-symbolic ways, in their nonverbal behaviour and vocalizations. However, it appears that they have a lack

whole project. Nim showed emotional reactions to the continuous replacement of humans, and these may have limited his use of the signs. Also, there was only a small number of caretakers that he trusted and liked to be with. Though he did not analyze this systematically, it appeared to Terrace that it was in the situation of being with trusted and loved teachers that Nim occasionally, though with low frequency, spontaneously named things. In order for a chimpanzee to acquire a motivation to sign about things rather than request them, Terrace thought that a close and stable relationship with his or her human companions appeared to be essential: "The difficulties in arranging for such stability remains, in my opinion, the biggest single obstacle to maximizing the linguistic potential of a chimpanzee," (Terrace, 1979a, p. 224). However, he did not consider it impossible that a new project might eventually provide such a stable environment and obtain new results that in fact show a linguistic use of signs or other symbols.[151]

4.4. Gardners on intentions: Intrinsic motivation to sign.

In contrast to Terrace, the Gardners claimed that Washoe and the other chimpanzees, apart from uttering requests, also sign to describe what they see, or simply comment on things in their environment (Gardner & Gardner, 1978; Gardner et al., 1989). From the start, the Gardners (1969, 1971) were certain that Washoe was able to learn to use signs to express requests for all kinds of objects and actions. However, already in their first publication they made it clear that the goal of Project Washoe was to teach sign behaviour that went beyond requesting things:

> For the project to be a success, we felt that something more must be developed. We wanted Washoe not only to ask for objects but to answer

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of interest in communicating referentially or symbolically, one might say in explicit terms, about their emotions, feelings, thoughts and other internal states.

[151] This final conclusion by Terrace did not get recognized by the Gardners. Instead, they misrepresented Terrace's standpoint in describing him as a scientist who claimed that his "investigations have revealed the outer limit of chimpanzee intelligence once and for all" (1991, p. 558). In their view he was not a scientist who assumes "that the best is yet to come, and future research will yield one surprise after another."

> questions about them and also to ask us questions. We wanted to develop behavior that could be described as conversation. (1969, p. 665)

To which they later added that they wanted her to make comments:[152]

> We wanted her not only to produce verbal responses to obtain goods and favors from us, but also to be interested in our verbal responses and to use her verbal behavior to stimulate our verbal behavior. What we had in mind could be described as a very interesting game that an infant chimpanzee would play with her human companions for the sake of the interaction itself. (1971, p. 125-126)

One anecdote has been presented various times (1969, 1989a) as an example of signing by Washoe that went beyond requesting:

> One day, in the 10th month of the project, Washoe was visiting the Gardner home and found her way into the bathroom. She climbed up on the counter, looked at our mug full of toothbrushes, and signed "toothbrush". At the time, we believed that Washoe understood this sign but we had never seen her use it. She had no reason to ask for the toothbrushes, because they were well within her reach, and it is very unlikely that she was asking to have her teeth brushed. This was our first observation, and one of the clearest examples, of behavior in which Washoe seemed to name an object or event for no obvious motive other than communication. (1969, p. 667).

They continued by describing that the first signs that Washoe acquired were simple demands. "Most of the later signs have been names for objects, which Washoe has used both as demands and as answers to questions" (p. 672). This remark about the functions of Washoe's naming is particularly relevant to the possible intrinsic motivation of apes for naming. If Washoe used the act of naming to request and to answer naming questions from the humans,

then this need not be interpreted as spontaneous naming or commenting for the sake of it. The Gardners further said in this article that: "Washoe readily used noun signs to name pictures of objects as well as actual objects and has frequently called the attention of her companions to pictures and objects by naming them." However, they did not clarify what was meant here by "calling attention." Did Washoe draw attention to them for the sake of it, or did she want something about these objects or pictures?

Further reference to the chimpanzees' "intrinsic motivation for communication" occurred when the Gardners talked about the performance of the chimpanzees in their object sign vocabulary tests. Children learning language behaved "as if they had an inborn, species-specific motive to communicate" (1984, p. 402), because they did so without any apparent extrinsic reward. A similar motive was then implicitly suggested for their chimpanzees. Their argument for this was that the chimpanzees performed worse in the vocabulary tests if they were given food rewards, whereas they readily named the objects without rewards (Gardner & Gardner, 1984, 1989). Indeed, the Gardners said it was Washoe who first taught them "the limitations of operant conditioning,": "We soon found out that the worst time to teach was the beginning of mealtime. The hungrier the chimpanzee and the more attractive the food, the more the teaching session dissolved into a frenzy of begging" (1988, p. 444). Besides it being impractical to reward every appropriate sign use, "all we could hope to teach Washoe in this way was a set of requests." Furthermore, "all connected discourse or conversational interaction would certainly be disrupted" by a stringent regime of reward delivery. Therefore, the Gardners' "only practical way to proceed was to treat Washoe the way human parents treat human children." In doing so "our communicative, social responses to her evoked communicative, social responses from her." They referred to this phenomenon as the

[152] Except for a few examples, of which the anecdote in the next quote is the most extensively presented, the Gardners did not define what the exact behaviours were when their chimpanzees were simply describing or commenting on objects and other things.

feedforward principle. Peer commentaries to the Gardners' article[153] criticized their claim and argued that the Gardners were still practicing reinforcement by using many social reinforcers with the chimpanzees. Baum put it this way:

> they actually switched to a relatively powerful and appropriate set of contingencies for the behavior being shaped. The consequences are there – smiles, talking, attention, tone of voice, touching – and they are frequent, immediate, and appropriate, not merely the results of request. (p. 448)[154]

A further reason why they considered the chimpanzees' signing to be intrinsically motivated was the fact that Washoe was still signing after having left Reno for 19 years (at the time of publication), and that their other cross-fostered chimpanzees were also still using the signs. The Gardners (1989a) therefore called the signing behaviour of the chimpanzees "a robust phenomenon." Their continued signing was also remarkable given the fact that during Project Loulis, the humans did not sign to the chimpanzees in Loulis' presence for more than five years. They said that this "drastic" deprivation procedure "slowed the growth of their sign language, but it certainly demonstrated that the sign language acquired by the cross-fostered chimpanzees becomes a permanent and robust aspect of their behavior" (p. 25). Their conclusion then was that: "once introduced, sign language is robust and self-supporting."

4.5. Asking questions.

Another communicative intention that has been explicitly ascribed by the Gardners (though they never used the words "communicative intention") to Washoe and the other chimpanzees, was the asking of questions (1974a, 1978, 1989a). They mentioned that "Washoe's descriptions and comments [about the world of objects and events that surrounded her] were not limited to replies to our questions; she initiated many of the conversations with questions

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[153] Four *Behavioral and Brain Sciences* commentaries in particular: that of Baum, Reid, B.F. Skinner himself, and Whitehurst and Fischel.

and opening statements of her own" (1978, p. 38-39). This suggests that Washoe was explicitly requesting information through the use of questions.

Only three examples have been published in which the particular questions were explicitly presented. The first was given when they reported that Washoe developed the signed equivalent for asking a question very early, the first observation being recorded in the 9th month of the project: "An interesting and common occasion for Washoe's use of questions was requesting names for pictures in magazines. .... She would verify the name for the picture by asking, *That food?*" (1974a, p. 18).

The second example was Moja's use of WHAT THAT? in the sample of 5 hours discussed in 1980 (see footnote 94 of this dissertation). No exact instances together with context descriptions were presented, though. All the Gardners mentioned was that this combination of signs was one of the most frequent combinations in the general context of looking through picture books.

The last example was from the field records and concerned a question asked by Tatu when she was 12 months old:

> Tatu takes a picture book and looks through it. I join her. Seems to be especially interested in pictures of flowers and of chimps. Tatu points to flowers, [and signs] THERE?, with raised eyebrows and prolonged eye contact. I sign FLOWER, then Tatu turns back to another page. (1989d, p. 238)[155]

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[154] Reid (1988) also mentioned that in the operant conditioning of behaviour not every occasion needs to be positively or negatively reinforced: "contingent responses are strengthened even if some of the possibilities of reinforcement are missed" (p. 464).

[155] De Villiers & de Villiers (1978) discussed a further example that was part of the film about Washoe: Washoe asking TIME EAT? They expressed their doubts concerning it being a real request for information:

> Unfortunately, a spontaneous situation like this does not convince us that Washoe intends a question. We need evidence that Washoe lacks information, seeks it, and then acts in accordance with it. It is puzzling that, for all the thousands of times Washoe was asked What's this? about an object, there are no reports that she asked for the name of a new object. Yet that is the first, and for years the most prevalent, question that children typically ask. (p. 185)

The asking of questions was considered by the Gardners to be one of the major findings of the chimpanzees' signing: "The fact that the subjects initiated most of the interchanges by themselves, with their own questions, requests, and comments, is one of the most significant findings of this whole line of research" (1980, p. 353).

4.6. Fouts on intentions.

In general, the Fouts claimed that the chimpanzees used signs in ways similar to human children using their developing language. So, besides making requests, chimpanzees readily named and described their environment. Examples of the naming or commenting use of signs were mentioned in Fouts' latest book (1997). There he described a walk with Washoe in Oklahoma: "As we rambled through the woods she kept pointing and signing at so many wonderful things all in one place: TREE, BIRD, COW!" (p. 123). He also claimed that the chimpanzees named the drawings and paintings that they made. Thus he said that "Washoe's paintings are bright and energetic, with titles like ELECTRIC HOT RED" (p. 280). Moja is then presented as "the first nonhuman to paint representationally, birds being her favorite subject," as she often titled them as BIRD.

In agreement with the Gardners, the Fouts have also drawn attention to the questioning behaviour of the signing chimpanzees (Fouts, 1975a, 1987; D. Fouts, 1989; Fouts & Mellgren, 1976; Gorcyca, Garner & Fouts, 1982). Thus they mentioned that the cross-fostered Lucy sometimes asked WHAT THAT? of her human companion during sign practice sessions:

> One of her favorite games is to steal an experimenter's pen and turn the tables on him by asking him "*What that*" referring to the pen as he tries to get it back. She will also ask herself "*What that*" to various objects she already has signs for while she is looking in a mirror and then proceed to correctly answer her own question. Most recently she was looking at several photographs of

> people she knew, and other things. She observed the photographs in a casual fashion except for one which she paid particular attention to and then she asked the experimenter "*What that.*" The photograph happened to be a picture of a chimpanzee wading up to its neck in water. (1975a, p. 150)

The Fouts mentioned that Loulis had also been observed to ask questions, and even that there had been use of the question modulators in the signing by the chimpanzees amongst themselves: "We have also observed the question modulators by Loulis in his signing to the chimpanzees as well as in his signing to humans" (D. Fouts, 1989, p. 250).

> It occurs most frequently during cleaning. Loulis will approach the person cleaning, who is hosing down the floor, and Loulis will look straight into that person's eyes with wide questioning eyes and then hold the sign *drink*, or *that hurry gimme* or *hurry hose* until the person cleaning vocally says "OK" or "Go ahead" and then he will drink from the hose. We have also observed this questioning eye gaze and facial expression between chimpanzees (Tatu and Washoe) during a remote video taping session of their signing interactions. (R. Fouts, 1987, p. 61)

Details about this interrogative signing between Washoe and Tatu have not been given.

4.7. Chimpanzees using signs amongst themselves.

The use of signs by the chimpanzees to communicate amongst themselves, presented by Fouts (1975a) as "intraspecific communication using ASL," has been put forward, implicitly and explicitly, as an argument that the intentions underlying the signing of chimpanzees were not restricted to making requests.

The use of signs by the chimpanzees to communicate amongst themselves was first observed in Oklahoma. When Washoe arrived in the chimpanzee colony of the IPS, she was observed several times to sign to the other, non-signing chimpanzees. The sign that she used

most with the other chimpanzees was TICKLE. She often used HUG to comfort the young chimpanzees. Often she also signed COME HUG when other chimpanzees appeared to be stressed or upset. Once something alarming (probably a snake) had been detected by the chimpanzees and they all ran away from the place where it might have been spotted. Washoe had just been grooming Bruno and ran away at the alarm calls of the others. When Bruno did not run away as well, Washoe signed COME HUG COME HUG to him, to which he did not respond (Fouts, 1975a, 1997; Fouts et al., 1989).

Fouts (1975a) did a further study on the use of signs between Booee and Bruno. He set up two situations which were thought to stimulate the use of the signs between the two chimpanzees: social separation, and a situation where only one chimpanzee was given a preferred fruit or drink. Social separation resulted in sign use that was described as "almost always appropriately limited to the *come*, *hurry* and *hug* sign in addition to name signs," (Fouts, 1975a, p. 149). In the preferred food/drink situation the chimpanzee without the desired object would sign to the conspecific holding the object, sequences such as GIMME DRINK and GIMME FRUIT (the only examples given in 1975a).

In an extension of this, the two chimpanzees were drilled to make the sign TICKLE before they were allowed to play a tickle-chase game with the humans and with each other:

> Soon spontaneous combinations began to appear without the intervention of an experimenter. For example, Bruno signed *tickle Bruno* to Booee and Booee answered *tickle Booee*, later in the sessions Booee signed *tickle* to Bruno and Bruno answered *Booee hurry come*. On one occasion Booee signed *tickle Booee* to Bruno as Bruno was eating some raisins out of an experimenter's hand and Bruno answered *Booee me food*. (p. 149)

Based on these observations Fouts and Rigby (1977) say that: "Activities such as tickling, play, mutual comforting, and mutual sharing are most conducive to communication in Ameslan between the chimpanzees" (p. 1048).

Other chimpanzees at the IPS colony, who were not taught signs directly by the humans, eventually picked up a few signs and used these in the communication amongst themselves. Fouts & Rigby (1977) report that a male chimpanzee called Manny used COME HUG when greeting or reassuring another chimpanzee. He and Washoe also signed COME HUG to each other when they wanted to have sexual intercourse with each other (Fouts, 1997). The three-year-old Kiko learned FOOD and DRINK.

In their assessment of chimpanzee-to-chimpanzee signing, the Fouts said that this use of signs went beyond the "gastronomic" (O'Sullivan et al., 1982; Fouts, 1987; Fouts & Fouts, 1989, 1993; Fouts et al., 1984). Though they too did not talk in terms of communicative intentions, they drew attention to the fact that in their 1984 analysis of the chimpanzee-to-chimpanzee signing (called "conversations"), only 5 % of 5200 utterances were related to food. Fouts (1987) explicitly said that this low percentage contradicted the criticism that chimpanzees only signed for rewards. A combined total of 88 % of the utterances were assigned to the behavioural contexts of play, reassurance, and a general category of "social interaction." These results confirmed a conclusion on the motivation for sign use as going beyond a sole interest in acquiring things: "This supports a position that these chimpanzees primarily use their sign language in a social manner," (1987, p. 68).[156]

Debbi Fouts studied the chimpanzee-to-chimpanzee signing using remotely controlled videocameras when no humans were present (D. Fouts, 1989, 1994; R. Fouts, 1987; Fouts & Fouts, 1989; Fouts, Jensvold & Fouts, 2002).[157] Her analysis provided more information on

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[156] In 1997 Fouts worded this conclusion as follows:

> When given the freedom to talk in a loving and supportive environment, Washoe's family used language the way a human family does, to build and maintain personal relationships in the course of daily life. The vast majority of their signing was related to play, discipline, housecleaning, and reassurance. .... Interestingly, even their conversations about food were more like human talk around the dinner table than anything one would call "begging." (p. 300-301)

[157] Fouts (1997) described how this particular form of datacollection came to be. Debbi, who originally had wanted to focus on Loulis' growing use of language, had mostly "Skinnerian psychologists" on her thesis committee:

> They were skeptical that Washoe's family was signing at all, and they recited the charges of Herb Terrace. Her advisers suggested instead that Debbi mount some cameras on the wall and videotape the chimps when no humans were around at all. They were certain that this would prove once and for all that chimpanzees only signed because they were cued by humans.

this particular area of chimpanzee sign use. In the publication of the study an example was provided for each of the six behaviour contexts that the signing was grouped into (Fouts & Fouts, 1989). It is unclear, though, what status these examples have (whether they were captured on film, that is). An example of the reassurance context was Moja signing HUG to Washoe. The use of CHASE by Dar and Loulis was an example of the play context. Then there was an example of sign use in the grooming context: "Loulis took Tatu's foot while signing THAT GIMME, and then probed a sore on her foot" (p. 299). The example of the discipline context was: "Tatu bit Loulis who responded by screaming. Next Washoe entered the room, swaggered bipedally at Tatu, thumped her with the back of the hand and signed GO to her. Tatu now screamed, and withdrew to an overhead tunnel" (p. 299). A signed utterance in the food context was also presented here: "Loulis, who had finished his meal, approached Washoe, who was still eating. Loulis whimpered and signed GIMME FOOD, and attempted to pull her bowl away. Washoe hugged Loulis, then took her bowl and moved away from him" (p. 299-300). An example from the "social interaction" context was not given though. There was only a definition which specified that it "encompasses soliciting objects or contact, and greetings and signs that do not fit into the other, more specific contexts described above. Undesignated affinitive and agonistic behaviors are included in this category" (p. 300).

One conversation, between Loulis and Dar, with six turns and three signed utterances, was then presented in detail:

Turn 1, Utterance 1: Loulis solicited a water balloon
from Dar by signing HURRY HURRY while holding his
hand toward the balloon.

Turn 2: Dar moved away from Loulis.

Turn 3, Utterance 2: Loulis signed WANT to Dar.

Turn 4: Dar again moved away.

> Debbi was thrilled at this idea. If the remote videotape could disprove chimp signing, it could also *prove* it once and for all. (p. 302)

Turn 5, Utterance 3: Loulis signed HURRY HURRY GIMME to Dar.

Turn 6: Dar terminated the interaction by putting the balloon into his mouth and turning away from Loulis who also withdrew. (p. 300)

A final example of a signed interaction was given at the end of the chapter under the heading of "Social Strategies":

> During a remote video-taping session Loulis used a social strategy that resembles one commonly used by human children. We recorded an instance of this, following a fight between Loulis and Dar. After the fight subsided, Dar moved away from Loulis, while continuing to scream. At the same time that Dar was screaming, Loulis approached and sat quietly behind Washoe and signed GOOD GOOD GOOD to her. Much like a human child he seemed to be assuring his mother that he was good. (p. 304-305)[158]

Besides these examples, no details were given of the actual utterances and precise situations in which Lou (the focus of the chapter and of the remote videotape study) used his signs towards his fellow chimpanzees. All that was mentioned was that he produced a sign 99 times in the social interaction context, 54 times in play, 26 in grooming and, lastly, 27 times in the reassurance context.

4.8. Chimpanzees using signs to describe emotions and other internal states.

Different from the Gardners, who made no remark on the subject, the Fouts have also claimed that the chimpanzees used signs to explicitly refer to their feelings, emotions and

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[158] Fouts (1997) even presented a situation that appeared as if Booee was showing or teaching Ally how to make signs:

> If Ally wanted something from Booee - usually a piece of food - Booee would wait for Ally to ask for it properly before giving it to him. If Ally was too shy to ask, which was usually the case, then Booee would poke Ally to get his attention and then sign YOU GIVE ME FOOD. Booee would continue this prompting until Ally looked up momentarily and signed YOU

other subjective, internal states. It was in 1976 that Fouts (together with Mellgren) did so for the first time. As an example it was reported that:

> On one occasion Washoe was observed to use the HURT sign to refer to a presumably painful stomach. She had all the symptoms of intestinal flu. She had diarrhea, a temperature, flatulence, and was generally inactive. When an experimenter asked her in sign language: WHAT WRONG WITH YOU? she responded by signing HURT to her stomach. (p. 336-337)

In a later publication (1983b) Fouts summarized Washoe's intentions in using signs as follows:

> Washoe made use of ASL just as do children. She initiated conversations about games, her wants, or to comment on things going on around her and so on. She lied in ASL, expressed her love or anger, and even commented when something was funny. (p. 142)

An incident then follows, that is more detailedly described in 1997. Fouts was giving Washoe a piggyback ride in the Gardners' backyard, while Washoe indicated by signing GO THERE what direction she wanted to be brought:

> After zigzagging around the yard like this for a while, I heard a snorting sound above my head. It was a distinctive sound Washoe made by contracting her nostrils whenever she signed FUNNY. I craned my neck up and sure enough she was placing her index finger on her nose in the FUNNY sign and snorting. For a second I couldn't figure out what was so funny. Then I felt something wet and warm flowing down my back and into my pants. (p. 31)

Washoe apparently had had a potty accident. In the 1983b publication Fouts continued by saying that "Washoe can talk about what she thinks, how she feels and when she's feeling sick or hurt" (p. 143). Indeed "what we have found, thanks to Washoe, is that chimpanzees

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GIVE ME FOOD. Satisfied, Booee would hand over the food. (p. 176, first presented in Fouts et al., 1978)

are not different in kind from ourselves. They can talk and express their thoughts and feelings" (p. 143).

In his latest book, *Next of Kin*, Roger Fouts frequently said that the chimpanzees used "sign language" to describe and share their feelings and thoughts. He presented the expression of emotions by Lucy in some detail, giving several anecdotes:

> I was not surprised that Lucy used her sign language from the very beginning to express her varied emotions and deep sensitivity. One day, in the middle of Lucy's lesson, Jane Temerlin drove up to the house. Lucy jumped up and wanted to end her lesson, but Jane was in the house only for a minute before she left again. Lucy pulled her chair to the window, watched her mother drive off, and then signed to me CRY ME, ME CRY. Another time, when Lucy was told that she had injured her cat's paws - she had tried to pull the cat away from a fence it was clinging to - she cradled her baby and signed HURT HURT. Whenever she met someone new she regularly inspected them for bandages or scabs and signed HURT HURT very sympathetically. (p. 155)

A major example of Washoe reporting emotions came from an anecdote about an interaction with caretaker Kat Beach, who was sad because she had had a miscarriage:

> MY BABY DIED, Kat signed to [Washoe]. Washoe looked down to the ground. Then she looked into Kat's eyes and signed CRY, touching her cheek just below her eye. That single word, CRY, Kat later said, told her more about Washoe than all of her longer, more grammatically perfect sentences. (p. 291)

Besides signs such as CRY and HURT that were claimed to refer to internal states, the chimpanzees were also said to have acquired signs that refer to moral and social values, such as GOOD (see Loulis' "social strategy" example on the previous page) and FRIEND. One anecdote on the use of FRIEND was given in 1997:

> Moja and Tatu spent a lot of time lying on the floor, holding magazines with their feet, leaving their hands free for conversation and comments. Tatu, especially, loved to find photos of men's faces and sign to them, THAT FRIEND TATU, which would be followed by many variations on this romantic theme. (p. 268)

Insulting signs.

In addition, Fouts has claimed that the chimpanzees used some of their signs to express their dislike of someone. This being a special case of expressing one's internal states, it is of interest to discuss this claim in some detail. In 1975a Fouts mentioned for the first time that Washoe used the sign DIRTY as an insult. The Gardners had taught Washoe the sign DIRTY in reference to feces, stains on clothes, furniture, shoes, and soiled items, as well as to the act of defecating and urinating (Gardner et al., 1989). Though it thus referred to both objects as well as actions, it was grouped in the special category of Markers and Traits in Table 3.1 of 1989.[159] Fouts described how Washoe first was seen to use the sign as an insult. They were in Oklahoma and Roger Fouts was teaching Washoe the sign for MONKEY. There happened to be some threatening and aggressive behaviour between Washoe and a male rhesus macaque in a cage behind her. Fouts stopped the aggression between the two and continued to teach the sign MONKEY. Then: "I ... asked her what her earlier adversary was (the macaque), and she responded with *dirty monkey* to each of my several questions" (p. 156). Fouts continued: "To make sure this wasn't an accident I turned back to the siamangs [whom Fouts had been using as a referent to teach Washoe the MONKEY sign]. She called them *dirty monkey* three times and then started calling them *monkey* again." Fouts' last words about this incident are: "In response to my questions in regard to the squirrel monkeys, she called them *monkey*.

[159] In the Gardners' 1973 film it is mentioned that DIRTY was one of Washoe's favourite signs when she acquired it. There are parts in the film where one can see Washoe repeating the sign on and on and on, signing DIRTY DIRTY DIRTY DIRTY DIRTY. Beatrice Gardner can also be seen smearing mustard on clothes and other objects, in order to evoke the DIRTY sign from Washoe.

Back to the macaque again and all of her responses to questions were *dirty monkey.*"[160] Fouts further mentioned that:

> since this time she had been observed on several occasions to use the *dirty* sign as an adjective to describe various experimenters who refused to grant her her requests. For example, when I refused to grant her request of out go to be taken off the island she called me *dirty Roger.* (p. 156)

Fouts (1975b) reported that Washoe had signed the same sequence of signs when she had requested FRUIT ME and Fouts had answered SORRY BUT I NOT HAVE ANY FRUIT. These utterances by Washoe were moreover interpreted to be an active modification of the grammatical function of a sign: "The chimpanzees have also changed the grammatical function of a word; i.e. a noun to an adjective" (p. 383).

Lucy also used DIRTY as an insult: "Once she referred to a strange cat she had been interacting with aggressively as a DIRTY CAT, and she has also referred to the leash (which she dislikes) as a DIRTY LEASH," (Fouts, 1975b, p. 384).[161]

Fouts further claimed that Washoe used derogatory descriptions when she was introduced to other chimpanzees for the first time in her life, upon her arrival in Oklahoma (1994; Fouts & Fouts, 1993). The chimpanzees banged and screamed at Washoe when they saw her. Roger Fouts then asked her what these chimpanzees were. Washoe signed BLACK CATS and BLACK BUGS. The Fouts (1993) explained these responses in the following way: "They were not like her and if she felt about them the way she felt about cats and bugs they were not liked" (p. 29).

Name calling was even claimed to take place among the chimpanzees themselves. Thus, Fouts (1997) said that at times when Loulis threw temper tantrums and spat at humans

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[160] The incident was reported under the heading "Genesis of insult?".

[161] Fouts' claim that chimpanzees insulted by using signs received great prominence in the press. As an example, Eugene Linden (1981) titled the first chapter of his popular book on the ape sign projects, *Apes, men and language*: "A chimpanzee that swears." The book included a drawing of Washoe signing DIRTY to the monkey. In the book Linden was very enthusiastic about the results of the Gardners and the Fouts' work. Washoe was described as the first chimpanzee to enter the "temple of language," and even as a Prometheus to the chimpanzees, in that she might learn language to them.

when they were doing other things than playing with him, "Washoe would stop calling Loulis BABY and would address him as DOG, as in, COME DOG!" (p. 263).[162]

The opposite was also claimed to occur, the chimpanzees expressing their appreciation and liking of each other. It was said about Moja and Tatu that they "loved playing with Loulis, whom they called PRETTY BOY" (p. 269). When Washoe was in Oklahoma on the chimpanzee island, she "made up a new term of endearment for the very darkskinned [chimpanzee] Thelma: BLACK WOMAN" (p. 135).

A still further use of "human sign language" by Washoe claimed by Roger Fouts was her expression of humour in jokes (1997). Though he did not give examples of the jokes that Washoe was supposed to make, he said on p. 47 that she made "potty jokes."

4.9. Private signing.

Another form of sign behaviour that could be interpreted as motivated by something else than simple requests, was the chimpanzees' private signing. In this particular use of signs, the chimpanzees were not making the signs within an interaction with a human or another chimpanzee. Instead, they signed privately when they were by themselves, or when their nonverbal behaviour (eyegaze, face orientation, posture) indicated that the signing was not directed to an interlocutor. The private, self-oriented nature of this sign use should at the least rule out a request intention. The utterances were not directed to someone, so there was no request being asked from a companion, either human or chimpanzee.

This private signing was first observed by the Gardners for both Washoe and the other cross-fosterlings (1972, 1974a). Terrace (1979a) too, stated that Nim would sometimes sign to himself. He would identify pictures and objects that he saw. Deborah Fouts (1989) found that private signing occurred on the remote videotapes that she had collected for her study on chimpanzee-to-chimpanzee signing. She gave a few examples on page 250:

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[162] Linden (1981) has an anecdote about Ally calling Fouts' assistant Bill Chown a nut when he did not respond to Ally's requests for tickling. Ally supposedly signed YOU TICKLE ALLY, YOU NUT! to Chown.

> Dar would sign PEEKABOO to himself while lying on the bench. While looking at pictures in a magazine, Loulis signed THAT FOOD. Loulis signed HAT while putting a wooden block on his head. Washoe signed BOOK after closing a magazine and tucking it under her arm. Tatu, while sitting alone on a bench, signed APPLE.

The phenomenon of private signing was later studied systematically by Mark Bodamer in two consecutive studies (Bodamer 1987; Bodamer, Fouts, Fouts, & Jensvold, 1994). The first extensive study of this behaviour was done by analyzing the chimp-to-chimp sign tapes that Debbi Fouts had collected with remote videocameras (Bodamer, 1987). The definition of private signing that Bodamer used was based on that of private speech in children, formulated by the developmental psychologist David Furrow.[163] Bodamer found 91 instances of sign use by the chimpanzees that could be defined as private signing. The majority of these consisted of one sign uttered privately (84 instances). In four instances a two-sign utterance was made (THAT FOOD 3x, and BLANKET CRY 1x). There were two three-sign utterances (DEB DIRTY DEB and HURRY GOOD MINE) and one four-sign utterance (THAT SHOE THAT SHOE). Twenty-six different signs were used in these utterances. Bodamer proceeded to assign the privately signed utterances to the category system Furrow set up for the functions of private speech of children of the age of 2. These consisted of the following 11 functions:

- Instrumental: reference to the child's wants ("I want it").
- Regulatory: reference to an event that might immediately be carried out ("Go there").
- Self-regulatory: reference to an event that the child might immediately carry out ("I put that there").
- Attentional: reference to a sensory event that is ongoing or might be carried out ("Look").

[163] Furrow used the direction of eyegaze as a means by which to determine the private nature of the speech. However, in transferring this operational definition to the chimpanzee species, it was found that this was sometimes difficult to determine on tape. Bodamer therefore modified the definition by focusing on head orientation rather than eye gaze. Thus, his definition of signing that was not private was as follows: "if the chimpanzees displayed any reciprocal face (head) orientation during the sign or the 2 seconds before or after the sign then it was not classified as private signing" (p. 16-17).

- Interactional: a conventional greeting ("Hi").
- Expressive: an evaluative opinion, expression of an internal state, or a stock phrase that expresses feeling ("I love you").
- Referential: reference to a present object or present event ("That").
- Describing Own Activity: reference to an ongoing or just completed event, involving the child ("Putting it").
- Question: ("What that?").
- Imaginary: the utterance is sung, word play, or represents a transformation of real objects or events ("That hat" (referring to wooden block on head)).
- Informative: reference to a non present object or event ("Daddy at work").[164]

The Expressive and Informative categories belonged to the four most frequent categories. Expressive was the most frequent category, while Informative came fourth in place. The results of this first study were used to formulate the conclusion that "these results indicate that, much like humans, chimpanzees talk to themselves in sign language" (D. Fouts, 1989, p. 250).

The second Bodamer study on private signing collected a larger corpus of private signing. The tapes that had been used in the first study were Debbi Fouts' videotapes, which were focused on capturing the interaction between the chimpanzees. During datacollection she had therefore not specifically looked for solitary chimpanzees being by themselves, and possibly signing to themselves. Though Bodamer still found 91 instances on these tapes, he proceeded in the second study to collect additional material through the use of remote videotaping. This time, however, the focus was on catching those moments where the chimpanzees were not interacting with each other, in the hope to obtain more instances of private signing (Bodamer, Fouts, Fouts & Jensvold, 1994).

[164] Supposing that it is justified to ascribe these categories to the chimpanzees' private signing, it is clear from this description that these categories are not expressing requests (except maybe the Instrumental and Regulatory category).

Every weekday 12 minutes of tape were collected for a period of 56 weeks between November 1986 and January 1988. This resulted in 56 hours of videotape. The chimpanzees were free to use all the enclosures in the Psychology Building of CWU, where the chimpanzees still lived at that time. The remotely controlled videocameras, however, could only film one enclosure at a time. As in the first study, humans were not allowed to enter this enclosure and its hallway. However, they were allowed to interact with the chimpanzees in the other enclosures, as long as they were not within visual range of the filmed enclosure (though they may have been within audible range).

Analysis of the videotapes resulted in a total of 368 instances of private signing.[165] This time the Referential category (based on signs referring to objects or events that were present) was the biggest category, accounting for 59% of all the instances. The Informative category was the next most frequent with 12%.

As in the first study, the conclusion was drawn that the private signing of the chimpanzees was "very similar" to the private speech of human children, because both could be grouped into the same functional categories. Bodamer et al. (1994) stated that "these chimpanzees, like ... humans ... displayed a wide variety of communicative functions in their private signing" (p. 294). They described the findings of both studies to have demonstrated that the private signing is a "robust phenomenon." Referring to the use of private speech in humans as a "window to the mind", they concluded that "continued evaluation of chimpanzee private signing [might] provide a glimpse into hitherto uncharted areas of chimpanzee mentality" (p. 294).

Within the discussion on the possible communicative functions underlying the private signing, the occurrences within the Referential category have been interpreted as evidence against Terrace's characterization of ape signing as acquisitive (Fouts & Fouts, 1993; Fouts, Fouts, Abshire & Bodamer, 1991). This was argued as follows: "Basically the individuals are

[165] The same rules and guidelines of the first study were used in assigning the instances to the different functional categories of private speech/signing.

simply commenting on things and events in their environment. They are doing it apparently just for the sake of it - they are not asking for it or begging for something" (Fouts & Fouts, 1993, p. 35). Bodamer et al. made a remark on displacement when they interpreted the instances assigned to the Informative category (containing references to things not present) to mean that: "The common notion that animals, other than humans, only refer to things in the present (e.g. out of sight out of mind) is thoroughly disproved [sic] by the robustness of the chimpanzee's private signing in the Informative category" (p. 294).

Especially interesting for the subject of communicative intentions were the Expressive and Imaginary categories. Consider the instances of Expressive private signing in Bodamer's first study. There the Expressive category was the most frequent one, accounting for 30% of the total. Washoe signed DIRTY 19 times, Dar twice. Washoe also signed DEB DIRTY DEB[166] and HUG/LOVE twice.[167] Lastly, Loulis had three instances here: he signed GOOD twice and the combination HURRY GOOD MINE. The second study on private signing provided for only 10 instances in the Expressive category, which took up a modest 2% of the total there. These consisted of Washoe signing DIRTY 8 times, PERSON/HEY[168] once, and Tatu signing STUPID once. In one of the instances in which Washoe privately signed DIRTY, the sign was again interpreted as an insult:

> Washoe was being recorded as she was lying on a bench looking at a magazine. Loulis came running into the room and into the camera frame from an overhead tunnel. He was running very fast and Washoe ignored him. As he

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[166] The Fouts (1993) interpreted this utterance as still another example of chimpanzees insulting with signs:

> Washoe did not seem to like the fact that everyone (all the humans at least) was required to leave the area during the taping. On one occasion after Debbi had positioned the cameras, shooed everyone out and gone back to the video monitoring room she saw on the screen that Washoe was approaching the cameras. Washoe then climbed up on the enclosure fence and looked directly into the camera and signed DEB DIRTY DEB. (p. 34)

Such signing to the camera, which appears to have occurred on a number of times, may actually not be fully private.

[167] The Expressive category accounted for 88% of Washoe's private signing in this analysis. Of her 25 utterances 22 were grouped in this category.

[168] No explanation is given why the instance of this particular sign was considered to be part of the Expressive category. Other occurrences of PERSON were grouped into the Referential and Informative categories (also without further explanation). In Bodamer's first study PERSON was considered to be indicative of the

> ran under the bench where she was lying he reached up and stole her magazine and then ran immediately out of the room using the overhead tunnel again. By the time Washoe got to her feet, Loulis was gone. She then began to walk off and as she did she signed to herself 'DIRTY DIRTY'. (Fouts & Fouts, 1993, p. 36).

Examples of the Imaginary category consisted of the following. In the first study (1987), Dar signed BLANKET CRY. Further information on the context in which this utterance was produced, however, was not given. What was said about the utterances in the Imaginary category was that they were all of the type called a transformation, such as renaming an object. Two further instances were the following.

> Dar was lying on his back on the bench. He reached towards the hose, grabbed it and signed (Referentially) THAT THAT THAT. Then he paused for 4 seconds, grabbed the hose again and signed SHOE SHOE SHOE SHOE on the hose. On another occasion Loulis signed DRINK while he was playing with a waterballoon. (p. 38)

In the second study 17 utterances were assigned to the Imaginary category. Three of these consisted of combinations of signs made by Moja. They were PEEKABOO RED, FUNNY BLACK FOOD, and QUIET RED FOOD CRY SANDWICH. No further information was presented, though, on the context of these utterances, nor of the reasons why these utterances were assigned to the Imaginative category. However, in the Fouts' 1993 chapter one of Moja's combinations above was interpreted as rhyming, singing or word play: "Moja produced an alliteration by 'rhyming' signs that all used the same initial hand configuration" (p. 36).

Interactional category, however. This was because it was claimed that the sign was often used to initiate an interaction.

Conclusion.

In summary, there is a strong difference in characterization of the chimpanzees' communicative intentions and motivation when using the signs, between Terrace, and the Gardners and Fouts. Terrace and his colleagues thought that ape signing was basically made up of all kinds of requests and might best be described with the term "acquisitive." Naming objects and pictures also occurred. However, social reinforcement might have been the reason for such chimpanzee naming, whereas human children named and used language as its own goal, or "for the sake of it." Only one behaviour, Nim's use of signs when privately looking at pictures, might not have been request-oriented. The Gardners and Fouts said from the beginning that chimpanzee signing went beyond uttering requests only. The chimpanzees were said to describe what they saw and made comments. They had an intrinsic motivation to communicate information, as evident from their participation in the vocabulary tests, and the robust nature of their sign use, still continuing after decades of the start of the projects. The chimpanzees also asked questions to obtain information from others. The Fouts presented the sign use of the chimpanzees amongst themselves as evidence for nonrequest-oriented intentions. These were supposed to be more socially oriented. Furthermore, the chimpanzees also described their internal states (with signs such as HURT, CRY, FUNNY), moral concepts (GOOD and FRIEND) and dislikes (in the form of insulting signs such as DIRTY). The private signing of the chimpanzees was another form of signing that could not be interpreted as uttering requests, in the absence of others who should carry out the requests.

CHAPTER 2

THE RESULTS OF THE PROJECTS WITH SIGNING CHIMPANZEES

5. LANGUAGE

As can be imagined from the foregoing sections, there has also been a great deal of discussion on language. That is, on the question of whether these nonhuman apes can acquire something akin to, or wholly the same as, human language. Indeed, this is the central point of debate within the ape language controversy. Discussion on subjects such as the methodologies used to teach the signs, the rearing conditions of the ape subjects, the methods of data collection and the design of experiments (some of which will still be presented in Chapter 3), are all minor points in the service of this major question: have the apes in the sign projects acquired a human language?

As can be expected by now, two positions again resulted. The Gardners and Fouts were adamant in their argument that the chimpanzees' sign behaviour showed so many similarities with human children's language production in their first stages of language development, that it would be biased and prejudiced not to call the ape behaviour language as well. Thus, they spoke of their chimpanzees having acquired *sign language*, rather than just signs. Terrace and colleagues held the opinion that there were strong dissimilarities between the signing chimpanzees and language developing children. They therefore considered it important to keep making a clear distinction between human language and the non-linguistic

forms of communication of great apes. Linguists and other scientists also discussed the language issue with regards to ape signing, usually basing themselves on the results and arguments of one of the two groups. In this section the different positions and their arguments will be presented.

Gardners on language.

When the Gardners' position in this debate is considered, it is of importance to keep in mind that they were strict behaviourists (Linden, 1981; Seidenberg, 1986; Wallman, 1992). They proudly say that they are in several publications (1974b, 1988).[169] This has two important implications for their understanding of language. The first is that language is defined as a form of behaviour. Second, behaviourism presupposes as a principle that the behaviour of different species is subject to the same fundamental laws, and therefore stresses continuity between species. These two postulates in themselves can predict what the Gardners will say on the subject of ape language, regardless of the exact findings of their research. The definition of language as just another behaviour, opens up the way to the application of the second principle, the thesis of continuity between all behaviours.[170]

Throughout the Gardners' publications several clear remarks are made that express this behaviourist perception of language. In 1971 they say that "general laws govern all of the

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[169] Their 1988 target article in the *Behavioral and Brain Sciences* shows that they are not uncritical behaviourists. In this discussion paper, they question one of the central laws of behaviourism, the law of effect. They do this by coming up with severe doubts about the effects that response-contingent consequences, or reinforcement, actually have on behaviour. Experimental procedures used to demonstrate such consequential effects, such as the yoked control procedure and Pavlovian conditioning, are argued to be faulty by design. They also refer abundantly to species-specific, obligatory behaviours on which shaping and reinforcement have little or no effect. Thus, rather than feedback controlling behaviour, they argue that a feedforward model is a much stronger explanation for learning behaviour. Stimuli evoke obligatory responses, thus feeding forward, instead of stimuli reinforcing arbitrary responses, feeding backward. Their experiences with the learning of signs by their apes is seen as a further demonstration of this principle. Rewarding the chimpanzees contingently on their sign responses depressed their learning. However, treating the chimpanzees as having a natural motivation for communication was a successful teaching method. The communicative, social responses of the Gardners evoked similar communicative responses from the chimpanzees (because of an assumed obligatory motivation to communicate).

[170] In 1971 the Gardners say:

> The assumption that linguistic behavior is subject to the same laws as other, more prosaic, and less exclusively human, classes of behavior is explicit in most modern theories of

behavior of all organisms" and therefore "it follows that the proper analysis of behavior is not in terms of simpler behavior and more complex behavior or in terms of simpler organisms and more complex organisms, but rather in terms of general functions, such as perception, learning, and motivation, that are found in all forms of behavior. We wish to avoid the need to invent new laws of behavior for each newly discovered level of complexity by formulating general laws" (p. 178). To create a dichotomy where one group of animals has language and another group does not, would therefore be a disrespectful enterprise for any comparative psychologist.[171] A division of the communicative behaviour of animals into language on the one hand, that only humans have, and communication on the other, for all nonhuman animals, has to be criticized.[172] They say that this division has resulted in the use of different methods and techniques to study the communicative behaviour of different animals. This in its turn ensured that no comparable data would ever be obtained. Because of these different kinds of data it will never be possible to make "legitimate comparative statements" (p. 179).[173]

> behavior. This assumption leads directly to the hypothesis that behavior that is at least continuous with human language can be found in other species. (p. 118)

[171] Similar remarks can also be found in 1969 and 1978.

[172] More words on continuity can be found in 1980:

> Those of us who argue for continuity tend to stress similarities in linguistic development of ape and child; those who argue for discontinuity tend to stress differences. In this atmosphere of controversy, the linguistic achievements of the chimpanzee subjects are often treated as positive results and the linguistic failures as negative results. But this is a basic misunderstanding of the continuity position. The notion of identity in the behavior of ape and man is as foreign to Darwinism as the notion of absolute discontinuity. For the same reasons that we expect significant similarities we also expect significant differences. The objective of this line of research is to measure the degree of overlap as precisely as possible. (p. 332)

Further discussion of (dis)continuity is presented at the end of Drumm, Gardner and Gardner (1986): "Truly discontinuous phenomena must be rare in nature. Historically, the great discontinuities have turned out to be conceptual barriers rather than rifts in nature" (p. 26). They then quote Jerome Bruner's foreword to Andrew Lock's (1978) *Action, gesture and symbol*, where he talks about a new trend in the study of human language: "the bridging of gaps that before were not so much empty as they were filled with corrosive dogmatism." One of these gaps is that "between chimps signing and man talking." Bruner thinks "that the renewal of interest in language as an interactive, communicative system has made these 'gaps' less like battlegrounds where one fights and dies for the uniqueness of man and more like unknown seas to be mapped." In 1991 the Gardners criticize the argument that a gap in evidence means a gap in the *scala natura*, the Aristotelian ordering of the animal kingdom along a scale where humans are placed above nonhumans, with which the Gardners disagree. They warn that absence of evidence is not the same as evidence of absence. Disregarding this important statement can lead to gaps in the scala natura that in effect, arise from gaps in scholarship: "Time after time these gaps in nature have turned out to be temporary gaps in human knowledge, soon filled in and obliterated by the next wave of research" (p. 558).

[173] This opinion leads them to a position that might be seen as resisting certain empirical data from linguistic studies when they say in 1978: "If a form of behavior such as human language appears to be different in

Their 1971 article contains other important and insightful remarks that further clarify their particular interpretation of language, and lead to a better understanding of the reasons underlying the conflict in the ape language controversy. The Gardners say that they want to develop a comparative psychology of "two-way communication," as they call it, wanting to avoid using the burdened term of language.[174] A first step then is to set up an operational definition of two-way communication. It is here that a central problem in the Gardners' approach is evident. Requiring operationalization means that only those phenomena are allowed to be studied that can be defined as observable behaviours. The Gardners then state that the problem that has stood in the way of operational definitions of communicative behaviour is the notion of intention that was implicit in the use of that term.[175] They say that this is "not an unusual problem" (p. 180), and that it has been "solved" in many areas of psychology. By this it is meant that intention has been expulsed from all theories and explanations.[176]

Intention taken away, the operational definition of communicative behaviour can be arrived at by isolating its function.[177] This function is supposed by them to be: the

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character from other forms of human and animal behavior, then we do not abandon the search for general laws; instead, we question the adequacy of existing observations" (p. 37).

[174] Fouts and Couch (1976) also explain the reasons for the Gardner terminology: "It should be noted that the Gardners ... justifiably refer to research of American Sign Language acquisition in chimpanzees as *two-way communication* rather than *language*. It is a semantic way of avoiding controversy, thus preserving an empirical background without moving too far into the field of theory" (p. 142).

[175] The Gardners' 1988 article has further clarifying remarks on operationalization. One of these is that "a principle without any possibility of operational definition is also without any scientific merit" (p. 437). Further on, on the same page they say that it sometimes can be "more straightforward and parsimonious" to dispense "with the notion of hedonism [experiencing pleasure and pain, or having likes and dislikes] altogether." Indeed, they conclude that "unless the likes and dislikes frequently imputed to living organisms have economic advantages, it is prudent to assume that they have been eliminated by evolutionary competition" (p. 438). Feedforward (see footnote 169), in their interpretation, is a model with no need for imputing hedonism, whereas feedbackward is not. See the article for further details.

In one of the peer commentaries following the article Bill Bechtel and Adele Abrahamsen link the Gardners' approach to that of logical positivism. They say that dispensing with the contingency principle "is justified only within a framework such as logical positivism, in which the failure to operationalize a concept renders it meaningless" (p. 448). Richard Marken (1988) concludes that the feedforward model is "pretty much business as usual," because it "looks a lot like S-R theory", being

> based on the same fundamental ... conviction ... that goal-oriented, operant behavior can be explained by environmental guidance. .... The model lets us continue to ignore the existence of *controlled variables* – environmental events controlled by the animal – thus missing the purpose of the animal's every move. (p. 461)

[176] This is of course only true of most behaviourist and some cognitivist theories and explanations.

[177] They consider Project Washoe to be an early step towards a type of study and explanation of two-way communication, devising tasks to isolate its function.

communication of information. From then onwards, it actually becomes a straightforward task for the Gardners to demonstrate that Washoe and the other chimpanzees have acquired language. The only thing necessary to demonstrate, is that Washoe is doing the same as human children using language: communicating information.[178]

The Gardners' procedure to compare the behaviours of their chimpanzees and that of human children is seen as a way by which to avoid the problem of the absence of a clear, commonly agreed upon definition of language. This is another claim by the Gardners. They say that linguists have failed to come up with a behavioural definition of language (1975). If there is no exact definition that all researchers use at any time, then the next best thing is to look at the behaviours that are called language in human children and then focus on obtaining observations of the same sort of behaviours in the chimpanzee subjects.[179] Young children that are developing language are then the "essential control group" for the signing chimpanzees (1980). Children provided the Gardners with norms, patterns and stages of language development that could be used as comparison material. These comparisons then result in finding actual similarities between children and the signing chimpanzees. They mention similarities

> in the childish or immature variants in forming signs; in the generalization of meaning of early signs; in the gradual increase of length of utterances; in the types of semantic relations expressed in the earliest combinations; in the replies to Wh questions; and in the use of order in early sentences. (1978, p. 73)

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[178] In fact, this was one of the major reasons for which they set up the vocabulary tests: to prove that their chimpanzees could communicate information by using their signs. As intention was abolished from their conception of language, the Gardners disregarded the question whether Washoe and the other apes really had the intention to participate in these tests. They explicitly state that in their test procedures: "the tasks were carefully adjusted to the motivation of our subject [to ensure participation, *ER*], but we were not concerned with her intentions" (1971, p. 181). In general, their perception of language devoid of intention allowed them to use rewards, drill, and other motivating methods to enforce cooperation of their chimpanzee subjects (see section 3.3.).

[179] "If children can be said to have acquired language on the basis of their performance, then chimpanzees can be said to have acquired language to the extent that their performance matches that of children" (1975, p. 244).

These similarities justify attributing language to the chimpanzees. They further speak about similarities in "age norms for attaining a given vocabulary size," (1980, p. 340). This is specified as not just acquiring larger vocabularies, but increasing the number of different types of word or sign categories within the vocabulary. They refer here to their comparison with Nelson's study on children's first 50 words (see its presentation in section 2.1.4.). The similarity in categories and number of lexical items in these categories between children's first 50 words and the chimpanzees' first 50 signs is another "striking parallel" that justifies the attribution of the term "language" (1994a).

In 1994b they claim that the similarities between chimpanzees and children also appeared in similar developmental patterns of growth:

> size of vocabulary, appropriate use of sentence constituents, number of utterances, proportion of phrases, variety of phrases, length of phrases, complexity of phrases, inflection, all grew robustly throughout five years of cross-fostering. The growth was patterned growth and the patterns were consistent across chimpanzees. Wherever there are comparable measurements, the patterns of growth for cross-fostered chimpanzees parallel the characteristic patterns reported for human infants. (p. 214)

The similarity in a major pattern of growth that is drawn attention to here, is the sequence in which the different semantic relations appear in children as well as in the signing chimpanzees.[180] Having thus presented the similarities with human children's language acquisition, the evidence is there: Washoe and the other chimpanzees have acquired language. "Clearly, cross-fostering chimpanzees with ASL as a medium of communication transmitted some degree of language to the cross-fosterlings" (p. 214).

In conclusion then, the Gardners' opinion that the transmission of information is the central function of language or two-way communication, together with the in their eyes exactly similar linguistic processes and skills of human children that the chimpanzees have

shown to possess,[181] makes it clear why they talk about *sign language* that the chimps have acquired.[182]

From then on they will use this conclusion to criticize traditional (and particularly Chomskian) linguistics: "The results of Project Washoe presented the first serious challenge to the traditional doctrine that only human beings could have language. Before Project Washoe the possibility of nonhuman language had always been raised in a yes-no, can-they-or-can't-they fashion, and had always been rejected categorically. .... Washoe required a radical departure from the traditional way of posing the question. She learned a natural human language and her early utterances were highly similar to, perhaps indistinguishable from the early utterances of human children. Now, the categorical question, can a nonhuman being use a human language, must be replaced by quantitative questions: how much human language, how soon, or how far can they go?"[183] (1978, p. 73).[184]

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[180] See footnote 95 in section 2.2. for a criticism of this sequence as a sampling phenomenon.

[181] They have started saying that the chimps go beyond language Stage III since the Wh-question tests. See the earlier sections for their conclusions that the ape and child utterances are basically similar.

[182] Intriguingly, the Gardners have also said that at the time they started Project Washoe it was already a proven fact that nonhuman animals had the capacity for language. In 1974a they say that "a large body of evidence [was] available ... which indicated to us that chimpanzees must have the requisite intellectual capacities" (p. 3), for language, or two-way communication. Reading on, it even appears that they equate language with problem-solving:

> We saw no need for further demonstrations that chimpanzees can solve problems which, according to one or another current theory of linguistics might be interpreted as analogous to the problems involved in the human use of human languages. Rather, we set out to demonstrate that a chimpanzee could achieve a significant degree of two-way communication by using a genuine form of human language.

In 1975 they refer to the "abundant evidence" that exists, from as early as the work by Wolfgang Köhler, that shows that chimpanzees can combine and recombine their learned responses in meaningful sequences, as justifying a belief that their own chimpanzees will be successful in meaningfully combining signs. Therefore, the goal of their project was not to prove that chimpanzees have "the aptitude or capacity" for language, but instead to find out whether "a chimpanzee could indeed *use a bona fide human language* [italics added]" (p. 245). It is remarkable that in this publication they reduce the whole question of language capacities in nonhuman animals as being a closed case that was already settled by work carried out more than half a century before. See Rumbaugh (1980) for a critique of this approach, saying that language is more than just the recombination of responses.

[183] This remark gets reformulated in 1980, and is also used by the Fouts. In the first publication on the results of Project Loulis (1982) it is paraphrased, in order to have the same expressive power, but now applied to the transmission of language: "The study of ASL acquisition by an infant chimpanzee from his mother has led us beyond the mere question of the possibility of cultural transmission of a language in a non-human species to the more manifold question concerning the nature and process of the establishment of a relationship with special focus on the communicative aspects in the formation and development of the relationship" (p. 189).

[184] In 1994c the Gardners relate their findings and position to a critique of Aristotelian logic and a promotion of what is called "fuzzy logic":

> There has been a trend rather than a revolution from static categories to dynamic functions. The more successful branches of science have thrived as they gradually abandoned Aristotelian categories in favor of dynamic functions. .... Aristotelian logic applies rigorous

Fouts on language.

The Fouts generally continue in the same manner of argumentation and interpretation that the Gardners started. Though they do not consider themselves behaviourists, they similarly focus on: continuity between human and nonhuman forms of communication being the only Darwinian possibility; the absence of a common definition of the term *language*; the best method being therefore a comparison of the behaviours of the chimpanzees with language-acquiring children; the many similarities existing between these two groups justifying the conclusion that their chimpanzees have acquired human language.[185]

Some additions by the Fouts to this discourse are the following. One of these is a variety of the continuity argument. Though there may be differences between language-using human adults and the signing apes, these are still differences of *degree* rather than *kind.*[186] Fouts and Mellgren (1976) say that a comparison of the linguistic behaviour of a 2-year-old

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> rules of logic to sharp, either-or, yes-no categories to arrive at definitive conclusions. This is its great appeal. The weakness of Aristotelian logic is that carving nature in this fashion yields crude categories and distorted descriptions of nature. This in turn invalidates any conclusion of Aristotelian logic that rests on such crude categories which returns us to the confusion we had when we started. Fortunately, there are alternatives to Aristotelian logic that can deal with continuous rather than discrete natural functions. (p. 3)

A "fuzzy" approach is suggested: "Rigorous logical systems that deal with continuous, graded, hence "fuzzy," inputs and outputs perform their tasks more effectively and more efficiently than categorical systems" (p. 4). They then conclude that:

> The evidence for continuous processes and variables [as found in the similar patterns of growth and development in the early utterances of both chimp and child, *ER*] contradicts the yes-no, either-or Aristotelian logic of philosophical linguistics that has prevailed for so long. What the children and chimpanzees actually say supports, instead, a position that is much more compatible with modern natural science. (p. 10)

The use of this "fuzzy logic" sounds suspiciously convenient, however, and works as an effective immunization against any form of critique that disagrees with their conclusion that the chimpanzees have acquired language.

In his concluding chapter of *Aping language*, the ape language critic Joel Wallman (1992) tries to interpret the apes' achievements from a similar "fuzzy" approach of (child) language. He is of the opinion, though, that there exist strong differences between apes and children, both in individual sign use as well as in sequences of signs. He therefore argues that ape signing "has a very low degree of membership in the fuzzy category child language" (p. 152). Using a fuzzy approach then, may not always lead to one and the same conclusion. Subsequently, Wallman draws into question the usefulness of a fuzzy approach:

> In fuzzy-set theory, however, *anything* can be considered a member of *any* category, albeit in many cases with a vanishingly small degree of membership. So to describe ape language as belonging to the category child language with a low degree of membership is to concede nothing to those claiming that the apes' accomplishments are significantly like those of children. Or the fuzzy-set framework can be discarded, and it can simply be said that what the apes do and what children do are very different. (p. 152)

[185] Based on the results with Booee, Bruno, Cindy, Thelma and Lucy, the following stark remark is even made: "The natural language acquisition process in human children is a lengthy one when compared to adult chimpanzee language acquisition, which can be induced in as little as one year" (Fouts, Couch & O'Neil, 1979, p. 304).

human child with that of a 22-year-old human adult might also lead to the conclusion that there is a difference in kind between these individuals. However, as they point out, such a conclusion only compares two separate points of language development, and fails to take into account the developmental processes that lead from one to the other. It fails to consider language as a dynamic process, but solidifies it as separate, static points. A similar mistake is made when a dichotomy is set up between human language and nonhuman communication, because such a dichotomy fails to take the evolutionary process into account. Later in their article they state that certain language studies thus suffer from "scientific apartheid." Fouts (1978a, 1978b) accuses some linguists of being prejudiced in that they have an "intellectually crippling approach of 'behavioral apartheid.'"[187] By limiting their study to one species only (the human), they come to the conclusion that that behaviour is only present in that particular species.[188]

A further criticism is that linguistics infers that language is unique in humans by ways of what is called negative evidence, that is, absence of evidence: "In this method, the scientist need only look around and NOT see something. From this he may conclude that the thing not

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[186] This conclusion can be found in Fouts, 1975b, 1983a, 1997; Fouts & Budd, 1979; Fouts & Couch, 1976; Fouts, Couch & O'Neil, 1979; Fouts & Fouts, 1993; Fouts & Mellgren, 1976.

[187] Fouts and Couch (1976) phrase it this way: "It appears as though a 'behavioral apartheid' has developed in that language behavior is perceived by many as unique to human beings" (p. 142). See Dupré (1991) for a more recent claim that making a distinction between human language and nonhuman animal communication is an apartheid view.

[188] Though Terrace may not have been explicitly attacked by the Fouts and Gardners as a prejudiced scientist who departs from an undarwinian, discontinuous idea of language, he certainly fits the profile. Reading through Terrace's work, however, one can find remarks that are in stark contrast with such a prejudiced attitude. For example, in the first pages of *Nim*, he describes the effect that the ape language experiments had on linguistics:

> One reaction has been to define human language in a way that would automatically exclude the achievements of the two dozen or so chimpanzees that appear to have mastered some of its features. In other words, if a chimpanzee can learn it, it isn't language. .... Of course, one could keep refining what a chimpanzee must do with language before its usage qualified as human, but imposing stricter and stricter criteria is little different from arguing that, by definition, only humans are capable of learning to use language as humans do.
>
> A more reasonable approach is to explore with an open mind the possibility of communicating with a nonhuman. It is not unreasonable to assume that some precursor of the ability to use language exists in apes, our nearest biological relatives. In trying to converse with a nonhuman, the worst outcome would be failure, but even failure would force us to rethink our own use of language. In seeking what is distinctive about language, we would acquire a better understanding of our nature, and any difference between our and an ape's abilities to use language could be described objectively, without recourse to a smug sense of superiority. That attitude only serves to mask our ignorance of what we really are. (p. 4-5)

seen in a particular species is totally absent in that species," (Fouts, 1975b, p. 373).[189] Scientists concluding that language does not exist in nonhuman animals based on negative evidence reason are comparable to "saying, 200 years ago, 'Human beings will never fly because they have never flown.'" (Fouts & Chown, 1976, p. 143). Similarly,

> to conclude that the chimpanzee is incapable of language because it failed to speak in one or a number of experiments would be comparable to concluding that life on other planets does not exist simply because we didn't find life on the moon or on some other planet. (Fouts & Mellgren, 1976, p. 320)

The Fouts (1993; Fouts, Jensvold & Fouts, 2002) are of the opinion that such a strategy is used by some to preserve an arrogant attitude of human superiority: [190] "We [those of us who try to maintain a false superiority] use the absence of evidence to claim evidence for absence with regard to sharing any traits that we think are important for our species' uniqueness" (1993, p. 30). Fouts (1975b) further says with regards to the professed absence of language in

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[189] See also Fouts (1978b, 1997), Fouts & Fouts (1993), Fouts & Rigby (1977), Fouts, Jensvold & Fouts (2002), and Gardner & Gardner (1991). Wallman (1992), however, makes it clear that the question at hand is not that apes can never learn language, but that the particular apes in the different projects have not learned it. The latter conclusion is what critics have claimed and not the former.

[190] The French philosopher René Descartes' perception of animals as machines is seen by them as the cause for current human arrogance. Against arrogance the virtue of humility is then introduced as a quality that played a role in ape language research, and is the solution to the debate:

> Washoe, among other chimpanzees, has served notice on this studied ignorance spawned by human arrogance. The results of her accomplishments have put many academic feet in many academic mouths. .... It was only when a few humans were humble enough to ask the chimpanzee what their nature was that these discoveries were made. However, these discoveries have not always been well received because of the obvious conclusion that must be faced: namely, that we are no longer demiurges. (p. 31)

Thus, the scientific arguments about ape language get drawn by the Fouts into a moral debate on human virtues and vices. They also hold Descartes, along with Plato, Aristotle, and Chomsky, as responsible for defending a dichotomy between humans and other animals, which has played a part in the ape language controversy (Fouts, 1978b, 1997; Fouts, Jensvold & Fouts, 2002; Linden, 1981). In 1987 Fouts depicts the debate as a fight against dogmas, and compares the Gardners to heretic scholars such as Galileo:

> The Gardners research was obviously very threatening to the proponents of Cartesian dichotomies. The Gardners are in the same position that Galileo was in facing a well established dogma, a dogma that is willing to forfeit scientific principles as well as the pursuit of knowledge in order to maintain the status quo. Fortunately for the Gardners, the "stake" has gone out of fashion. Unfortunately, many of the critics have shed more heat than light on the subject and are better understood in clinical psychology rather than in the objective view of experimental psychology. (p. 65)

Besides alluding to this attitude of human superiority in scientific arguments, Fouts has also referred to it in talks on the moral status of chimpanzees. In a recent conference on the legal status of chimpanzees at Harvard University, Fouts discussed the way in which chimpanzees are currently treated by humans and "drew an analogy to Nazi Germany: 'We abuse animals to make ourselves feel better, and we justify it,' he said – just as Nazis justified their attacks on Jews and the mentally retarded" (Gudrais, 2003, p. 21).

other animals, that "this may be a result of the inability of investigators to 'break the code'" (p. 373).

Another argument added by Fouts (1997) is that grammar in the signing ape's productions can only be expected, when one considers animal behaviour in general. "All animals impose order on the world by perceiving and then following rules in nature. So it was not all that remarkable that humans or chimps would also impose order on words" (p. 165). Indeed, Fouts equates grammar with following rules:[191] "If language does have a biological basis in the brain mechanisms of our mammalian ancestors, as I believe it does, then grammar is just a complex form of rule-following behavior" (p. 167).[192]

In his latest book (1997), Roger Fouts has more ammunition against especially the Chomskian perception of language. He specifically attacks the idea of a language acquisition device, or language organ, that is unique to the human species only. He says, first, that there is no anatomical evidence for such an organ in the human brain. Second, he argues that "there simply wasn't enough time" (p. 94), for this device to develop in the six million years that humans diverged from other apes in evolutionary history.[193] Because chimpanzees and

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[191] In 1975b Fouts expresses the same line of thought:

> There is one characteristic of language behavior in humans and chimpanzees that seems to be essential to not only language acquisition but to the competent integration of other behaviors as well. It might simply be called rule-following behavior. It appears that animals are able to perceive relationships between events in the environment and between events in the environment and themselves. They seem to be able to incorporate these relationships into their own behavior and then behave in accordance with them. The specific behavior is not important; it might be climbing a tree or it might be using language. ....the important point is that he climbs the tree in a lawful fashion; i.e. he always goes up head first and undoubtedly he must combine muscle movements in a novel fashion specific to that particular tree. From one point of view this bears a strong resemblance to a person combining the various constituents of language in order to complete a grammatically correct sentence. But this is presently only an idea that is still in its neonatal stage and will obviously require much more refinement. It is basically the idea that animals have an ability for perceiving rules, incorporating them, and then applying them to appropriate situations. (p. 375)

[192] Further on he says that "gesture *is* grammar" (p. 195). This is because signs are made according to rules that sometimes mirror the grammatical notation of subject-verb-object. Consider a gesture whereby one's right hand is swung across one's body and catches the upraised finger of one's left hand, called "hawk caught gopher." Such a gesture can be considered to be the most primitive form of syntax, according to the sign language experts Armstrong, Stokoe and Wilcox (1995). As explained by Fouts: "The dominant hand is the agent (it acts), its swinging grasp is the action (verb), and the stationary finger is the patient or object" (p. 194). One can agree with Fouts that an individual gesture, like "hawk caught gopher," sometimes coincidentally makes grammatical rules visual. However, this is not the same as actually combining multiple signs in a structured, grammatical way to convey novel meanings.

[193] Fouts calls Chomsky's theory therefore "a *deus ex machina*, a modern version of the ancient belief that language was a gift from the gods" (p. 95).

humans are "sibling species," finding a language organ in humans alone would be similar to finding a trunk on only one of the two sibling species of African and Indian elephants. Indeed, Fouts is quite ardent when he says that: "These modes of communication [the chimp and the human one, *ER*] must be grounded in the same ancestral cognition, *or Darwin's theory of evolution is wrong*" (p. 95). Fouts considers the results of the ape sign projects to be direct evidence against Chomsky's view of language: [194] "If Chomsky was right, then Washoe didn't have a language acquisition device and she wouldn't be able to combine signs meaningfully" (p. 97).[195]

Fouts further says that the "point" of Project Washoe was not that "chimpanzees were the same as humans or that they could master language to the extent that humans can" (p. 106). Children's first productions with words or signs are also not the same as adult use of language. However, if it is not "identical," it is "similar" to adult language. In this same way, what the ape projects proved is that "the chimpanzee's capacity for language [is] *similar* to a human child's but not exactly the same" (p. 107).[196]

Terrace on language.

Terrace and his colleagues draw quite different conclusions on the language issue. According to them, it is unjustified to use this term to describe the sign productions of Nim and the other signing apes. Their argumentation is as follows. Language's most prominent characteristic is the meaningful combining of individual symbols into sentences. This is what actually distinguishes language from other behaviour, such as the separate use of individual symbols. However, sentences have not been found to be part of the signing apes' combinations of signs. In general, there are so many differences between the sign use of the apes and the

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[194] The results of the ape projects point to an interpretation of language evolution that "utterly contradicted" (p. 92) Chomsky's theory of human language acquisition.

[195] In a conference on the legal status of chimpanzees in September 2002 at Harvard University, Fouts accused Chomsky of "pandering to human arrogance in order to sell books" (Gudrais, 2003, p. 21).

[196] This remark is very useful in the ape language debate. One can thus claim a strong similarity with human language while at the same time rebut critics by saying that one never said that what apes do is exactly the same as human children do.

language use of human children, that there is no foundation to argue from similarity with child language that the apes have language as well.

In contrast to the Gardners and Fouts, Terrace and his co-workers are not of the opinion that there is only disagreement on the actual definition of human language. They say that psychologists, psycholinguists and linguists generally have come to agree that grammar is the main characteristic of language, even though there may be disagreement on the actual specific nature of that grammar and on issues such as the existence of an actual language acquisition device (Terrace, 1981, 1984; Terrace et al., 1979, 1980). Grammar is the capacity by which new meanings can be expressed through the combination, rearrangement and recursive composition of individual words. By use of grammar, humans can express an infinite number of newly composed sentences with a finite number of words. The question with regards to ape language then, should be whether apes are capable of forming sentences. Important in this respect is that "a mere sequence of words [or symbols, *ER*] does not qualify as a sentence" (1981, p. 95). [197] Sentences are "sequences of words whose structure is governed by a grammar" (1980, p. 373). They express semantic propositions through the use of different words and phrases that have specific semantic and grammatical relations to one another (Terrace, 1979a, 1979b; Terrace et al., 1979, 1980).

Terrace and colleagues admit that the great apes in the language experiments (including their own) have demonstrated to be capable of acquiring vocabularies of individual arbitrary symbols.[198] They call this "a significant achievement" (1980, p. 373), which falsified the earlier idea that apes were incapable of doing so. However, as has just been defined, it is not the ability to use individual symbols that is evidence of linguistic

[197] See also Lenneberg (1980).

[198] It had been the results of the earlier experiments and the implied claims presented by their investigators, especially those regarding the combination of symbols, that prompted Terrace to start Project Nim. For this reason, the main goal of his project was to determine whether Nim could produce meaningful sentences, in other words, whether evidence could be gathered that an ape could acquire actual human language (1979a, 1981, 1983; Terrace et al., 1980).

competence.[199] Other animals such as dogs, rats and horses, can also be taught to use "words," in order to obtain certain rewards (Terrace, 1979a, 1985a, 1985b).

The results of Project Nim prove that Nim's sequences of signs do not justify an interpretation of these as actual sentences, governed by grammatical rules. They only superficially resemble the sentences young children make. In fact, Nim's strings of signs show non-linguistic strategies of combining signs that are motivated by the desire to acquire things from his human companions. The important role of imitation in Nim's production of signs further points out that alternative, non-linguistic processes can account for his sign sequences. Analysis of public films about the other signing apes results in similar conclusions on these other ape subjects. Furthermore, there is absence of any evidence that the apes in the other projects are capable of producing actual sentences. The conclusion by Terrace and his colleagues then, is that at least all of these particular apes did not demonstrate a mastery of language:

> For the moment, our detailed investigation suggests that an ape's language learning is severely restricted. Apes can learn many isolated symbols (as can dogs, horses, and other nonhuman species), but they show no unequivocal evidence of mastering the conversational, semantic, or syntactic organization of language.[200]

Terrace and colleagues thus see a major difference between the signing apes and human children, in that the latter quickly start producing sentences, whereas the former never even reach the point of making sentences. Other differences have become evident from the analysis of the videotaped sessions with Nim. The chimpanzee shows a larger rate of imitation, interruption and repetition in comparison with children. Finally, the motivation of the apes in the language projects is more limited than that of children. Recall that Terrace

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[199] To contrast the use of separate words with that of full sentences, Terrace (1979a) produces the following apt sentence: "Imagine the difficulty of understanding this information [the book *Nim* itself, *ER*] if it were presented one word at a time" (p. 7).

[200] These are the final sentences of both Terrace et al. 1979 and 1980.

used the word "acquisitive" to describe their communicative intentions when signing with humans. Children, in contrast, have an intrinsic interest to use language "for the sake of it," to exchange information[201] and to intensify their social bonds with parents and caretakers (1979a). For all of these reasons, Terrace (1983) concludes that human children's sophisticated ability for language "still stands as an important definition of the human species" (p. 40).

In the same vein, Seidenberg & Petitto (1979) conclude that the results from the projects suggest that the apes' behaviour is "fundamentally non-linguistic" (p. 180).[202] The ape subjects have only learned a "standardized system of gestures" that does not exhibit the critical features of human language. They point out the clear differences that were found in Project Nim between ape signing and early child language. The claims of the Gardners and Fouts to the contrary, are "far too strong" and not supported by good methodology and unambiguous results. In 1987, they include Kanzi in their conclusions (see a discussion of the work with this pygmy chimpanzee in chapter 5), and point out that the predominant way in which apes use their learned signs or lexigrams is to request. This makes them see the apes' use of signs as tools, to obtain desired outcomes, rather than as language.[203] Seidenberg (1986) concludes that the results of the ape language studies "provide positive evidence for the independence of a uniquely human language faculty" (p. 50).

> When the research on both the linguistic and non-linguistic capacities of apes is considered, it strongly supports the idea that language results from a biologically given, species-specific, autonomous faculty. Only this hypothesis

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[201] He says in 1979a:

> Indeed, what gives human language its richness and complexity is the extent to which it is used for purposes other than the immediate gratification of basic needs. Were it not for the need to exchange information, it is doubtful that our ability to create sentences would have developed to the extent that it has. (p. 21)

See also note 16 in section 2.4.

[202] Seidenberg (1986) comes to the "radical" conclusion "that there never was any evidence that signing apes exhibited linguistic skills" (p. 44).

[203] Ristau & Robbins (1982) refer to the philosopher Gilbert Ryle's distinction between "knowing how" and "knowing that" as useful in this discussion. If the critics are right then "the ape is demonstrating 'knowing how' to get a reward but does not understand what he is 'saying'" (p. 150).

provides a principled explanation of the behavior that has been observed. (p. 29-30)[204]

Seidenberg also criticizes Fouts for inappropriately appealing to evolution as an argument: "The problem is that general evolutionary facts are sometimes used in order to *establish* behavioral similarities." However, such a strategy is only a form of circular reasoning: "Evolution is a theory of speciation, not of behavioral continuity. From the fact that various primates shared a common ancestor and the fact that species evolve, no specific behavioral commonalities necessarily follow" (p. 30).[205]

Other scientists on language and signing chimpanzees.

Many linguists and other scientists have written on the issue of language with regards to the signing apes. Most of these base themselves on the results of Project Nim and the supposed inadequacy of the claims of the Gardners and Fouts. Others, however, have stood up for the results and conclusions of the latter, considering Washoe to be the first ape to have acquired (something like) a language. These authors will now be presented, since their writings and arguments help to further clarify the language issue in ape signing.

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[204] He continues: "This is a positive, non-trivial result, although not necessarily one the ape language researchers would themselves promote" (p. 30). Seidenberg & Petitto (1987) call the found dichotomy between the apes' demonstrably remarkable intelligence and their "dismal" linguistic abilities, to be "the single most important finding to have emerged out of modern ape research" (p. 284). See also Limber (1977) on the subject of clever apes failing to learn language.

[205] He also argues against the strategy of using data on genetic similarities between humans and apes (such as that humans and chimpanzees share about 99% of their genetic material) to defend behavioral similarities. For example, in their 1979 publication Fouts, Couch and O'Neil say that

> it would be naive not to expect differences [between the different primate, including the human, species, *ER*]. It would be just as naive, however, to assume that these species do not have similarities, including the basis for a behavior such as language. The assumption that language developed solely in the human species pushes the mechanisms we know of genetics and evolution to an extreme (and probably incorrect) conclusion. In fact, the striking physiological similarities between humans and chimpanzees with regard to blood protein and type, chromosomal characteristics, and structural similarities in the two brains would lead one to the opposite conclusion. (p. 297).

They then mention the new finding that chimpanzee and human blood differs by only 0.2% (see also Fouts, 1997). Seidenberg criticizes this particular line of reasoning by saying that:

> it is as though the new genetic discoveries indicate that we are more similar in behavior than previously thought. However, the molecular biological facts have no bearing on identifying behavioral continuities across species; they are facts about body chemistry, not behavior. Overlap at the level of DNA is consistent with the existence of such continuities, but does not itself validate (or invalidate) them. (p. 31)

The American linguist Steven Pinker is of the opinion that apes have not grasped what language is about. He has explicitly attacked the claim that positioning language as a uniquely human capacity would be undarwinian:

> If human language is unique in the modern animal kingdom, as it appears to be, the implications for a Darwinian account of its evolution would be as follows: none. A language instinct unique to modern humans poses no more of a paradox than a trunk unique to modern elephants. No contradiction, no Creator, no big bang. (p. 342)

In strong contrast to Fouts above, he says that language could simply have evolved after the human evolutionary line split off from its common ancestor with other great apes: "The result would be languageless chimps and approximately five to seven million years in which language could have gradually evolved" (p. 345). Pinker explains that there may even have been about 350,000 generations between an early human ancestor with something like a proto-language, and modern humans equipped with a universal grammar. He also rebuffs the criticism that the claim for a uniquely human language is undarwinian because that claim somehow excludes the existence of intermediate stages of evolution. Pinker says that these intermediate stage certainly have existed. However, they are no longer present in our time, since the individuals having the intermediate abilities (our own ancestors) are no longer alive. Pinkers' arguments show that it is a mistaken standpoint to maintain that evolutionary continuity inevitably implies the current existence in nonhuman animals of abilities similar to human language.[206]

Noam Chomsky himself has addressed the question whether the utterances of Washoe and other apes can be interpreted as evidence for language beyond the human species. He has

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See also Ristau & Robbins (1982).

[206] Ristau and Robbins (1982) similarly say that "man can exhibit both continuity and uniqueness, for he as well as any other species represents a unique adaptation" (p. 142). In this extensive article dealing with all ape language experiments done at the time, Ristau and Robbins elaborately discuss the results and problems encountered and do this in a fair way, both giving criticisms as well as pointing out intriguing phenomena found in the research. Their main message, though, is that more evidence is still necessary to describe the ape productions as linguistic.

done so in a paper published in 1979, *Human language and other semiotic systems.* For Chomsky the main characteristic of human language, that sets it apart from all other forms of animal communication, is a finite grammar, a system of rules and principles "that specifies [the] phonetic, semantic and structural properties of an infinite class of linguistic expressions" (p. 32). The crucial element of grammar is the hierarchy of phrases, on which structure-dependent rules operate, with recursive embedding being "the basic device for constructing new phrases" (p. 34) (see also Koster, 1989). Human language thus makes possible the expression of propositions (verbal attitudes represented as "I think that...," "I believe that...," "I want that...," "I hope that..") and even the description of entities and subjects that are wholly imagined.

As for the functions of human language, Chomsky can be quoted as saying that it is "characteristically used for free expression of thought, for establishing social relations, for communication of information, for clarifying one's ideas and in numerous other ways" (p. 35). Of relevance to the ape language debate is his further remark that "crucially, there is no basis for the belief that human language is used 'essentially' for 'instrumental ends' - to obtain some benefit" (p. 35-36). He does not specify this argument further in this article, but it is presumably based on all the functions and possibilities of language just mentioned. [207]

When he addresses the question whether the different communication systems learned in the ape language projects might count as a language, Chomsky first has some words of caution. He specifically says that gross functional or phenomenal similarities between language and other systems do not need to have any further implications. He makes an analogy with the examination of flight in the science of biology. If one would define flying as

[207] In an interesting review article of the development of communicative functions, Chalkley (1982) specifies the following as functions that are unique to language, that is, impossible to express in non-verbal ways: focusing the attention on a specific event or idea; being able to purposely divorce the content of a message from its purpose (as in joking, teasing and lying); being able to refer to something that is removed in time and space or not present in the here and now (among which are internal states, abstract concepts, contingencies and conditions). To promise, to warn, to invoke social rules and to clarify messages can be placed within these broader categories of linguistic communicative functions.
Frijn and De Haan (1990) mention as language functions that go beyond communication: aid in thinking or in the expression of emotions, and play with language.

"an act in which some creature rises into the air and lands some distance away, with the goal of reaching some remote point" (p. 32-33), one might say that humans can "fly" about 30 feet. Looking at gross functional similarities then, both humans and birds such as eagles could be said to fly. However, this would mean very little to the further study of actual bird flight. The same situation is the case with gross similarities of the ape "languages" with human language, such as that in both communication takes place. These similarities can be meaningless in that they do not grasp the essential defining characteristics of both systems.

Chomsky is skeptical at forehand about the possible existence of language in other animals, before even considering the results of the different language training projects. This is because there is no other animal that is already using language in the wild. If a capacity for language in other animals would only show up after humans trained them to use it, then this would amount to "something of a biological miracle" (p. 36). Considering the many biological advantages language has for survival, proliferation, and so on, it would be strange that the animals never used the capacity before human intervention. Such a situation would be comparable to one where "we were to discover in some remote area a species of bird that had the capacity of flight but had never thought to fly" (p. 36).[208]

Examining the results from the actual experiments in teaching language to other animals, he concludes that no evidence has been found for such a capacity. The systems that have been taught differ from human language "at the most primitive and elementary level" (p. 38). The differences concern the following aspects. First, there are differences in formal structure. The learned systems are finite, that is, there is no possibility for an infinite number of expressions, except simple combining that confers no altered meaning to the utterance. As such, there are no actual phrases, nor recursive embedding or structure-dependent rules. Then there are differences at the semantic level. There is an absence of basic semantic elements of human language such as "modality and propositional attitude, description and presupposition,

aspect and anaphora and quantification, and so on" (p. 38). Differences also exist in the use of the systems:

> Such elementary and primitive uses of language as telling a story, requesting information merely to enhance understanding, expressing an opinion or a wish (as distinct from an instrumental request), monologue, casual conversation, and so on, all typical of very young children, seem utterly unrelated to the functions of the ape systems, which appear to be strictly instrumental. (p. 39)

The similarities that have been found are only "very little," and "at a very general level" (p. 38). He mentions the "'use of symbols' in reference or to evoke action, serial order, perhaps some kind of limited substitution in frames" (p. 38). These similarities are not specific to human language, however, and apply to other systems of communication as well, even non-primate ones. Chomsky's conclusion then is that

> recent work seems to confirm ... the not very surprising traditional assumption that human language ... is outside of the capacities of other species... The differences appear to be qualitative; not a matter of "more or less," but of a different type of intellectual organization, so it appears. (p. 43)[209]

A fellow ape language researcher, Sue Savage-Rumbaugh and her colleagues have had considerable skepticism about the evidence for language in the signing chimpanzees. They

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[208] Savage-Rumbaugh & Lewin (1994) criticized this remark by saying: "Would Chomsky suggest that an ape's precise control of a joystick linked to a computer game must be an illusion, because they don't do this in the wild?" (p. 166).

[209] Chomsky also explicitly discusses several of the Gardners' arguments about their chimpanzees having acquired language, because these show "fallacies" and "curious examples of reasoning" (p. 41). He criticizes their argument that the apes exhibit the first stage of language development because of the similarities with early child language. This argument is fallacious, because early child utterances are only considered to be early language since it is known that children eventually will develop full-fledged language. The Gardners' reasoning does not follow. Consider as a similar example: "a child may "flutter his arms" more or less in the way a fledgling flutters its wings, but we cannot conclude from this fact that the child is exhibiting "incipient flight motions" (p. 41).

The Gardners' arguments concerning all behaviours being subject to the same general laws are considered to be "quite odd, to say the least." He disagrees with their belief

> that the discovery that two systems are organized and function on the basis of quite different principles implies abandonment of the search for "general laws" (it may lead to the denial that there are "general laws of behavior" of any significance, but that is quite another matter). (p. 41)

have drawn attention to three major characteristics of Washoe's (and the other chimpanzees') use of signs, that throw doubt on it being comparable to language. The first of these is that according to them the apes do not appear to comprehend the signs when others use them. The second problem is the multitude of repetition in their utterances: "Why did Washoe use so many words over and over, and why were signs like 'you' and 'me' a part of so many utterances" (1998, p. 205). The third characteristic is motivational:

> Washoe did not seem to learn signs unless she was taught them. Often it took hundreds of trials or more for her to learn a new sign... There were many signs that Washoe did not spontaneously produce unless someone held up or pointed to an object. (p. 205)

Another, more fundamental reason why Savage-Rumbaugh does not believe that the signing chimpanzees have acquired language, is that there is no evidence that the signs are true symbols that refer.[210] These criticisms are also interesting, because Savage-Rumbaugh worked under Roger Fouts in Oklahoma, with Washoe, Lucy, Booee and Bruno in particular, from 1970 to 1975. Though it may be that she is bashing all other apes in order to bring out her own bonobos as exceptionally special,[211] she is presenting information here about her own experiences while working with the signing chimpanzees.[212]

Furthermore, the Gardners' proud exclamation that comparative psychology implies looking for such general laws, does not follow: "this assumption is by no means a necessary consequence of a commitment to study behavior as a natural, biological phenomenon" (p. 42).

[210] See her arguments on this matter in Chapter 5.

[211] She has certainly done this in earlier publications, especially in her book with Roger Lewin (1994). There she claims that the bonobo is an exceptional ape, which far outpaces the common chimpanzee in intelligence and language abilities. However, in her later book with Shanker and Taylor (1998), she is considering the common chimpanzee to be more on an equal level with the pygmy chimpanzee, partly because of results of her own work with Panzee and other common chimpanzees at the Language Research Center in Atlanta. The above quotes about Washoe, however, come from this later book, so it appears that they are not just made to bash the common chimpanzee in favour of the bonobo.

[212] In her book with Lewin of 1994, she extensively describes her years with the signing chimpanzees. After initial enthusiasm, she

> began to be uneasy about how much they actually comprehended. The unease would always emerge when I tried to engage in true communication, that is, when I asked them a question for which I did not already know the answer.
>
> This missing component could similarly manifest itself whenever I asked the chimps to do simple things, such as to hand me a familiar object. Unsure how to respond, they would often begin to sign back rather than try to do what I asked. (p. 43)

She relates an anecdote that occurred after she had expressed her doubts to Roger Fouts about the chimpanzees' comprehension of signs:

A maybe more positive approach has come from the linguist Derek Bickerton (1990). He suggests that the signing of apes may be proto-language, an intermediate stage before full human language. In his book on the question of how language evolved, *Language & Species*, he infers the possibility of such a proto-language from four types of communication that all show certain aspects of language, yet that all remain at a level below the full-blown version of modern, adult language. The first of these "almost-linguistic" forms of communication is the "language" of apes in the language experiments.[213] Bickerton comes to the following conclusions with regards to ape "language." He argues that the signs of the apes are not produced by learned associations limited to the particular individual objects that the sign was learned for. The apes use it for categories of objects, so therefore it may be justified to say that the signs are associated with concepts. Nevertheless, the apes' vocabularies are small, and they are limited to lexical items. Grammatical items such as articles, auxiliaries and prepositions are generally absent in the apes' sign communication.[214] There is also no evidence for syntax in the apes' productions of sequences. True sentences may not have been made. Depending on one's definition of language one may conclude positively or negatively on the question of whether the apes acquired language. Bickerton then suggests that one

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> [Roger] insisted that Washoe understood what was said to her... Okay, I responded, can you demonstrate that Washoe really understands requests that are made of her? Certainly, said Roger, as we talked sitting on the bank across from the chimps' island one day. He turned to Washoe, looked around the island, and noticed that a long rope lay near the center of the island. Washoe, on the shore, was looking up at us. Roger turned to Washoe and signed, "Washoe, go get string there." He gestured in the direction of the string. Washoe looked puzzled, but did begin walking in the direction that Roger had pointed. She looked at a variety of things on the island, touching them and looking back at Roger, as if trying to determine what he meant. She walked right past the string several times and each time Roger signed, "There, there, there (again pointing), there string." Finally, as she again approached the area where the string lay on the ground, Roger began to sign "yes, yes, yes" and nod his head emphatically. As Washoe reached the spot, she picked up the piece of string and was praised fulsomely. "See," said Roger, "she just had trouble finding the string." I was not convinced. (p. 45-46)

Soon then, Sue became known in Oklahoma as "the unbeliever."

[213] He refers here to the projects by the Gardners and Fouts that used signs, as well as to the other experiments that used plastic symbols (Premack) or lexigrams (Rumbaugh and Savage-Rumbaugh). For reasons of succinctness, though, I will present Bickerton's ideas by mentioning only the signing apes. However, it should be clear that what he says applies equally to the apes in the other language experiments.

[214] He is of the opinion that had the researchers put more effort into learning these grammatical items to the apes, the presence of syntax could have been more definitively examined. With the information there is now "one cannot entirely close off the possibility, unlikely as it may be, that apes could acquire language in its fullest sense" (p. 108).

could interpret the symbol use of apes as an early, primitive form of language, not showing the full or defining characteristics of it, and therefore more adequately termed as proto-language. Indeed, proto-language may have been an actual earlier evolutionary form of communication before language fully developed.

Bickerton argues that there are three forms of human "language" that are similar to the ape's productions, in not showing full language ability, yet resembling it to some extent. These are: the "language" of children younger than two years old; the "language" of "wolfchildren" and other individuals that missed language exposure from early on (such as Genie, the victim of child neglect who only started to learn language at age 13, see Curtiss, 1977); and what are called pidgin "languages," that is, simplified communication between individuals who speak different languages.[215] According to Bickerton, all of these show the following similarities to ape language: many one-word utterances, a general absence of grammatical items and of structure in sequences. No substantive formal differences are present between all four.[216] The commonalities between these four forms of communication are to Bickerton evidence of proto-language, being a mode of expression quite separate from normal language.[217] In Bickerton's theory, then, the productions of the signing apes are considered proto-language. It is thus not full-fledged adult human language, yet it is on a par with early human language, the language of children about two years of age.[218] The question,

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[215] Examples of pidgin languages are: the pidgins that spontaneously arose in European tropical colonies in the communities of slaves who originated from different countries; and the earliest stage of second-language acquisition, like the limited communication of tourists in a foreign country who do not know the native language.

[216] There is one big difference, though, that Bickerton allows between the utterances of children and those of apes. This is a difference in motivation, that is, in the subjects that both groups talk about. Apes are solely interested in acquiring objects and actions, whereas children are also intrinsically interested in expressing information, what he calls "categorization for categorization's sake" (p. 114). He calls this difference nonlinguistic, though.

[217] Terry Deacon, whose work on symbols will be discussed in chapter 5, does not think it possible that something like a primitive language or proto-language could exist. There cannot be a nonhuman animal language made up of isolated words or signs only, without any combination rules. Such a phenomenon would ultimately be "a contradiction in terms" (p. 83). This is because the relationships between words and, therefore, of combination of words, are the central aspect of symbols, and thus of language. So either there is language, or nonlinguistic communication, but no halfway mixture in the form of a primitive language.

[218] Bickerton thinks that calling the productions of children under two not language but proto-language may solve some of the controversy in the ape language debate. One then does not need to deny anymore that the utterances of apes and children are sometimes identical, in order not to have to ascribe language to the apes. The

though, is whether the construction of something like proto-language has its basis in reality and is not just a theoretical idea convenient to combine different phenomena. Of course it is possible to find some common aspects in the communications of the four groups of users of Bickerton's proposed protolanguage. However, one can argue that ape "language" is still different from the other three "languages," in that the latter contain more internal structure. The utterances that Bickerton presents of Genie and of some pidgins still appear to be more complex and varied than the signing ape utterances. And even the language of children under two appears to have differences with that of the signing apes (as mentioned throughout this dissertation). The evidence for an actual protolanguage may be more seeming than real.

One of the linguists who are convinced by the Gardners' and Fouts' data that chimpanzees have acquired language or American Sign Language, is Philip Lieberman (1984, 1991).[219] Indeed, he is an enthusiastic defender. He concludes that the "data that are presently available indicate that chimpanzees have the biological capability for communicating in a linguistic mode" (1984, p. 226). He agrees in particular that the signed utterances of the chimpanzees are similar to the one- and two-word utterances of human children. Basing himself on the Gardners' publications, he claims that the chimpanzee utterances are "generally similar to those of many children through the age of 2 years ... and in some respects to the age of 3" (p. 247). In response to the criticism that language should involve the element of displacement, he retorts that children also "do not typically discuss situations displaced in time and place" (p. 228). This is what Lieberman has to say about the critics: "Although rigorous criticism is a necessary element in scientific discourse, the attacks

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similarities can be granted, because in proto-language both apes and children are simply producing utterances that are not fully linguistic.

[219] William Stokoe (1983) is another linguist who, though contending that the apes are still "two or three or more logical levels away from any real language," is nevertheless very impressed with the signing apes' abilities. In a later publication he concludes that the apes do not appear to be capable of complex syntax, and that "the extent to which they have been able to learn aspects of language remains a bone of considerable contention" (Armstrong, Stokoe & Wilcox, 1995, p. 130). Others convinced by the Gardners and Fouts include Watt (1974), who phrases his conclusion as follows: "To put it as baldly as possible, chimps can "talk." They have now been shown to have an ability so irrefragably on a continuum with our own speech that the chimps' ability cannot well be denied the adjective linguistic" (p. 70). Even the famous child language expert Roger

that Terrace and his colleagues have launched on ape-language studies are excessive and are not consistent with published data" (p. 240). Their "major fault" is "the systematic misrepresentation of other investigators' work, particularly that of the Gardners" (p. 246). Lieberman even calls Nim a "wolf-ape," that is, an ape who was raised in an "aberrant environment" of social deprivation, like the "wolf-children" who are neglected by humans and eventually raised by wolves and other wild animals. Nim's classroom is called a "prisonlike environment." Indeed, "Terrace applied strict Skinnerian theory and treated Nim as though he were a super-rat" (p. 245). Looking at Lieberman's criticisms of Terrace (expressed in chapter 10 of his book), it is clear that he misunderstands Terrace's arguments and the nature of Project Nim (see the discussion of criticisms on Project Nim in chapter 2.3.).

The chimpanzee expert Jane Goodall is another scientist who is convinced that the signing of the chimpanzees can be characterized as language (1986; Peterson & Goodall, 1993). She wrote the introduction to Fouts' 1997 book. In it she calls the story of Roger Fouts and Washoe "one of the most remarkable scientific, humanistic, and spiritual tales of our time" (p. ix). Her conclusion on the results of the Gardners' and Fouts' work is as follows:

> [The chimpanzees'] proficiency in ASL shows that they can understand and use abstract symbols in their communication. Washoe was even able to pass on this skill to her adopted son. It is our recognition of these intellectual and emotional similarities between chimpanzees and ourselves that has, more than anything else, blurred the line, once thought so sharp, between human beings and other animals.
>
> This is a little humbling. Of course humans are unique, but we are not as different as we used to think. We are not standing in isolated splendor on a

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Brown (1970, 1973) was convinced by the Gardners' reports that Washoe was able of Stage I language, because her productions were "very much like" the first sentences of children.

> pinnacle, separated from the rest of the animal kingdom by an unbridgeable chasm. Chimpanzees – especially those who have learned a human language – help us intellectually to bridge the imagined chasm. (p. x)

Conclusion.

The language question played a central role in the ape language controversy. The Gardners and Fouts came to the conclusion that their apes had acquired a human sign language. They used both empirical and theoretical arguments to defend this position. The most important of their theoretical arguments was the idea that it would be undarwinian to propose a discontinuity between human language and nonhuman animal communication. Behaviourism played a central part in the Gardners' theoretical argumentation. They stated that language is a behaviour that is subject to the same fundamental general laws as all other forms of behaviour. They also ousted the concept of intention from language. Allowing only operationalized concepts they arrived at the communication of information as the function of linguistic behaviour, which the apes in their projects had demonstrated. In order to avoid further problems concerning the disagreement in science on the exact definition of language, they used empirical comparisons of the signing chimpanzees with human children who were said to acquire language. These showed many and close similarities between child language development and the sign use of the chimpanzees, both in the different aspects of language acquisition as well as in the patterns of development. All of this evidence justified the ascription of sign language to the chimpanzees.

Terrace and his colleagues came to opposite conclusions. Using the results of Project Nim (and their own analyses of the other projects) they argued that the empirical evidence argued against the interpretation of the chimpanzees' behaviour as language. Taking the creation of sentences as the most important characteristic of human language, they showed that Nim and the other apes had failed to produce these. Various other clear differences

between the signing apes and children acquiring language were evident from the video analyses and other comparisons, among which the apes' large rate of imitation and acquisitive motivation. Language should therefore still be considered a unique and species-specific human ability.

This debate on language in the controversy drew in quite a few other linguists and scientists, including Noam Chomsky himself. He and others such as Pinker argued that the Gardners' and Fouts' main theoretical argument was fallacious. There is no reason to claim that darwinism implies no qualitative differences between species. The discontinuity in such a conclusion is only apparent. The evolution of language may well have occurred in the human ancestry alone, after humans split from other apes about six million years ago. The intermediate stages between nonhuman communication and human language are no longer there because our ancestors are extinct. Thus continuity does not preclude qualitative differences between different species. Bickerton tried to interpret the signing of apes as proto-language, a stage before full-blown language. Still others, like Goodall and Lieberman were convinced by the Gardners and Fouts and concluded that it was language that had been found in Washoe and the other chimpanzees.

Summary of Chapter 2.

In order to summarize the different sections of Chapter 2, Table 2.5. will recapitulate their main contents. In the table, the results of the different projects with signing chimpanzees are presented and the major conclusions of the Gardners and Fouts are compared with those of Terrace and colleagues.

Table 2.5. Main results and major conclusions of the projects with signing chimpanzees.

	Gardners and Fouts	Terrace
SIGNS		
Reliable vocabulary of chimpanzee subjects at end of project	Washoe: 133 signs. Moja: 168. Tatu: 140. Dar: 122 (end of G projects). Loulis: 51 reliable+observed signs.	Nim: 125 signs.
Semantic categories of individual signs	Objects, actions, (generic) names, person terms, locations, colours, possessives, materials, quantitatives, comparatives, qualities, request markers, traits, question signs, and others.	Objects, actions, names, person terms, locations, colours, qualities, request markers, traits, and others.
Further conclusions on individual signs	Striking similarity with early vocabulary human children.	Skewed use of signs: very frequent use of wild card signs.
COMBINATIONS		
MLU	Objections against this measure.	No increase, fluctuation between 1.1 and 1.6 signs.
Semantic relations	74 to 90% of combinations: same relations as in human children's first combinations.	No variety in semantic roles. After video analyses: no evidence.
Creative combinations	Occurred often. Washoe: WATER BIRD for swan.	No evidence. Strings may be unrelated or randomly generated.
Sign order	Several position patterns reflecting syntactic rules.	Unknown what orders reflect. Imitation has a role.
Inflectional devices	Reiteration and establishment of loci.	Repetition only to get what the chimpanzees want.
Multiple-sign combinations (3 and more)	Increase in informational content. Repetition and redundancy also present.	No increase in information. Characteristics: repetition, redundancy and wild card signs.
DISCOURSE		
Spontaneous signing	Spontaneity only defined with regards to imitation. Great majority of sign interactions initiated by chimpanzees.	Nim 10 to 13% spontaneous (no preceding human utterance). Less than human children with adults.
Interruption	Normal turn-taking behaviour.	Nim 71% overlap with human. No grasp of turn-taking.
Imitation	Imitation as pragmatic device. Less than Nim. Criticisms on Project Nim to explain different results.	Unexpected finding: 39 to 54% of adjacent utterances has imitation. Higher than human children.
COMMUNICATIVE INTENTIONS	Requests for objects and actions. Naming, making comments, asking questions. Intrinsic motivation to communicate information. C-c signing socially oriented. Internal state reports (CRY, etc) and insults (DIRTY). Private signing.	"Acquisitive" motivation: requesting objects, actions, etc. Naming. Private signing. Children, however, use language "for the sake of it."
LANGUAGE	Chimpanzee subjects acquired human sign language. Continuity argument. Many similarities with child language development.	No evidence for language. No sentences. Big differences with human children.

CHAPTER 3

PROBLEMS OF METHOD AND INTERPRETATION.

What has become clear in Chapter 2 is that there are many different results and conclusions on the apes' signing behaviour in the different projects. On most aspects of the chimpanzees' sign use there are important points of discussion. These points of controversy are sometimes difficult to decide upon. This is because many data and conclusions suffer from serious problems in the methods that were used, and in the way in which some results were interpreted. The sections in this chapter, Chapter 3, contain a discussion of the problems of methodology and interpretation that occurred in the different projects with signing chimpanzees. These problems throw doubt on some of the conclusions that were drawn by the projects' investigators and have implications for the comparison of the sign use of apes with the early language of human children. In this first section the status and use of anecdotes and individual observations will be discussed. The next section will center on the importance of systematic analyses of substantial corpora in this area of research. The amount of corpora used in the different projects will be presented. In the third section the role of drill in the human-chimpanzee interactions will be assessed. A substantial presence of drill, prompting and routine, or static patterns of interaction can result in the chimpanzees producing signs only to fulfill the human demand to sign. In the fourth and last section, further criticisms and several additional problems particular to the projects will be presented and discussed.

1. ANECDOTES AND INDIVIDUAL OBSERVATIONS.

The first major problem concerns the reliability of the data. Many of the observations in the chimpanzee sign projects were made by one individual only, without a permanent record such as film or video being available to check the observation. These individual observations stood at the basis of quite a few conclusions on the results and nature of the chimpanzees' signing. Anecdotes, stories of such observations, also occurred frequently in the published accounts of the project leaders. At the end of this section of the chapter the exact use of individual observations and anecdotes in the different projects will be summarized. First the problems of using this material will be discussed.

There are three methodological difficulties in using individual observations or anecdotes.

1. *Errors of perception.*

Errors in the human perception of the actual behaviours of the chimpanzees may occur. These can result in the human observer mistaking some of the behaviour. Thus, a scratch or some other non-signing behaviour may be mistaken for an actual sign. For example, a chimpanzee might be scratching his or her arm. This could be mistaken for the sign BRUSH, which is made by rubbing the hand on the arm. In another example, suppose Dar is rubbing behind his ear with his fingers. A human could then interpret this as Dar making his name sign, DAR, since this is done by the index pointing up and contacting the ear, while moving forward. Another example might occur when a chimpanzee is scratching at or around his or her eye. Such scratching might then inappropriately be interpreted as the chimpanzee making the sign CRY. This sign is made by (the tip of) an extended index rubbing down the eye or cheek below the eye.[220]

[220] Wallman (1992) quotes a report from a deaf ex-volunteer on the Gardners' second project in which he claims that such errors occurred regularly: "The hearing people were logging every movement the chimp made

Also, a sign may be taken for another, by misperceiving part of the PCM of the sign. This can happen with signs that are close to each other in place, configuration and movement. Take as an example the signs WASHOE and ROGER. WASHOE is made by an open hand, fingers pointing up, while these are rubbing forward at the ear.[221] ROGER is signed with the index and thumb grasping and pulling the ear. Though each of these signs is distinct from the other, an error in perception may cause an incorrect observation. Washoe signing WASHOE might be wrongly observed as her making the name sign ROGER. Perceptual errors can particularly occur with clusters of signs that are all made at more or less the same place, but that differ slightly in their exact configuration and movement(s) of the hand(s).[222] In the chimpanzees' vocabulary, one such cluster consists of signs that are made by contacting both hands and includes the signs IN, MORE, MOJA, SHOE and SODAPOP. The sign IN is made by (the fingers of) a curved or open hand inserting or grasping the palm or fingers of the other hand. MORE is made by the fingertips (or knuckles) of opposite hands contacting (repeatedly). The sign MOJA is done by the fingertips of one open hand rubbing the palm of the other open hand. SHOE is done by contacting the index edges of the fists of both hands (repeatedly). SODAPOP, lastly, consists of two movements: first, the tip of the index of one hand inserts on the fist of the other hand, which is then followed by the full palm of the active hand contacting the index edge of the fist. Often the chimpanzees will make only the last movement, the palm contacting the fist, which is glossed by the Gardners and Nichols as POP. The small differences between these five signs can sometimes cause mistaken perceptions. For example, an observer might erroneously perceive the sign SHOE for the sign MOJA. Another cluster of signs centers around the indexes of both hands and consists of the

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as a sign. Every time the chimp put his finger in his mouth, they'd say, "Oh, he's making the sign for *drink*," and they'd give him some milk" (p. 54) (original quote in A. Neisser, 1983, *The other side of silence*).

[221] Whenever a sign within the chimpanzee's vocabulary is described throughout this dissertation, the PCM of that particular chimpanzee's sign will be given, as described in Table 3.2 of Gardner, Gardner and Nichols (1989), or in relevant texts by Fouts. As was said before, it is not the description of a sign from American Sign Language, though it is sometimes close to the gloss's equivalent in ASL. Obviously, the name signs of humans and chimpanzees in all the projects were invented signs that did not exist before.

[222] A study by two ASL experts, Poizner and Lane, showed that misidentification of signs also occurs with clusters of human signs that have the same place of articulation (Wallman, 1992).

three signs BANANA, CAN'T and HURT. BANANA is made by the index grasping the tip of the other hand's extended index and pulling it towards oneself (Washoe's PCM), or by the (tip of) an index rubbing repeatedly along the index (edge) of the other hand, usually extended from a fist (PCM for Moja, Tatu and Dar). CAN'T is signed by (the tip of) an extended index contacting the other hand's (tip of an) extended index while moving the active hand down. The sign HURT is produced by contacting the tips of extended indexes of opposite hands (sometimes near the site of injury). With these three signs then too, bad observations may happen that confuse the signs within the cluster.

Such errors of perception can have drastic consequences, as one can see in the variety of different signs within the clusters given as examples. A combination with BANANA such as TATU BANANA might be misperceived as TATU HURT or TATU CAN'T, while (SODA)POP GOOD could be mistaken for MOJA GOOD or IN GOOD.

Production errors by the chimpanzees also occur. In the analysis of their vocabulary tests the Gardners (1984, 1989b) and Fouts (1973) found that the chimpanzees made common form errors with certain signs. These were especially errors where an incorrect hand configuration or movement would be made at the correct place of the sign. Thus, instead of signing FLOWER by bringing bunched fingertips to the nose, the chimpanzees would sign BUG, made by only touching the thumb to the nose. CAT and APPLE were also a common confusion. Both are made at the cheek, but for the CAT sign the hand simulates a movement of pulling at imaginary whiskers from the cheek, whereas for APPLE the knuckles of a fist hand rub against the cheek. Other form errors were: PIPE and DRINK (both made against the lips), SODAPOP and SHOE (see above), and ORANGE and BIRD.[223] Fouts found that 77%

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[223] The Gardners specified that the predominance of these form errors occurred in the following clusters of signs, grouped according to the common place of the signs in these clusters: IL = within lips; OL = around lips; MF = midface; HD = upper head and side of head; HN = hand; PE = periphery (arms, trunk and legs).

> Fouts (1987) describes that Allen Gardner stated in a discussion in 1983 that:
> the form errors are much stronger evidence for the chimpanzees understanding sign language than the conceptual errors [errors among signs with a similar meaning or conceptual class, such as COMB and BRUSH, NUT and BERRIES, or DOG and COW, *ER*]. After all, he pointed out, only a chimpanzee that knew sign language would be able to make a form error, by confusing one sign with another sign that was similar in its form but not its meaning. A

of Booee's errors in his vocabulary test consisted of confusions between the form-related signs LISTEN, LOOK and KEY, which are all made with an extended index finger, but at different places. Terrace et al. (1980) also mention that they observed Nim making "errors of topography" between signs that were close to each other in PCM. The fact that these production errors occurred as a regular phenomenon is all the more reason for the existence of perception errors. If the chimpanzees make errors in producing signs that are similar to each other in form, then the humans in the projects can make errors in perceiving signs with a somewhat similar form.

An additional problem is that this presence of chimpanzee production errors may not always have been detected by the human observers. Consider an example in which a chimpanzee signed ORANGE FLOWER when looking at some pictures. The chimpanzee might have wanted to sign BIRD BUG as guesses to name a picture, but he or she made two production errors, resulting in ORANGE FLOWER. The human observing this may not note the errors and report that an interesting attributive relation was made by the chimpanzee, when in fact the chimpanzee was only making a few guesses in naming a picture.

A related problem is that sloppy signing may occur. The chimpanzees may not clearly produce the PCM of the signs, but may be fiddling around with their hands and fingers, putting them through the movement only halfway or halfheartedly, or shaking them in disorderly ways, blurring a clear view. Sloppiness can occur when the chimpanzees are in an unmotivated state and only produce some approximations of the signs. It can happen at a moment when they are not really interested in communicating and are mainly trying to please the humans by producing some signs. Such sloppiness can cause many errors in perception. This is especially the case where signs are close to each other in PCM, as in the mentioned clusters. Also, it may happen that sloppy signing gets reinterpreted at the instant by the human, trying to see in some sloppy hand movements an actual clear sign. One should keep

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chimpanzee producing a sign language version of a malapropism is strong evidence for being competent in sign language. (p. 64)

in mind that the human observers were participating in a highly fascinating project in which the first great apes were being taught to use signs. They may have been so eager and enthusiastic that they may well have read more clarity and structure into what they saw than what may actually have been there.[224]

Being focused on interesting sign use, observers may also have had distorted perceptions of the sequences of signs that the chimpanzees produced. These may then have been retrospectively interpreted as creative combinations. Consider a hypothetical example in which a chimpanzee is perceived to sign BUG FLOWER for a rose. This may then be interpreted as a creative combination. However, it may have been the case that the chimpanzee was not signing BUG FLOWER but only sloppily signed FLOWER. The chimpanzee may have been fiddling a bit too much with the fingers at the nose. This may then have led to an erroneous perception of the signing as two distinct signs, BUG and FLOWER. This observation may then enter the data as the sequence BUG FLOWER, which is then interpreted as a creative combination.[225]

Other perception errors may occur when sequences of signs are made that quickly that one or more signs within the combinations fail to be observed, or observed accurately. Also, objects such as furniture, the bars of the caging, and other chimpanzees may sometimes stand in the direct line of sight, occluding a clear view. Even a small occlusion could then cause misperceptions of signs, again particularly in the clusters of signs.

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[224] See also Umiker-Sebeok & Sebeok (1980) for an extensive discussion of problems of perception and recording of observations in the different ape language projects. Other relevant remarks on this subject can be found in Hediger (1980), and Sebeok (1980).

[225] Another point of concern that Umiker-Sebeok & Sebeok (1980) draw attention to is that the independence of the observations (a requirement of the Gardners' observed and reliable sign criteria) in the projects may not have been that strong. This is because the teams of assistants and teachers had frequent group discussions of the signs that had been observed, which could then subsequently influence the expectations and, ultimately, the perception of other observers. Under such circumstances, another observer may be more prone to interpret a nonsign gesture as the sign that had been reported on yesterday's group meeting. This is similar to the process of eye witnesses conferring together which may then lead to prefabrications in the individual witnesses' accounts.

2. *Errors of memory.*

The next problem of individual observations is that errors of memory can occur when the observed signs and signed utterances are recorded at a later moment. In these situations, the perception at the time that the ape signs were made may have been correct and unfaltering, yet, memory errors take place in the time it takes to come away from the interaction and then record the conversation in the field log or other (usually paper) records (Ristau & Robbins, 1982). Memory errors can occur especially in remembering all exact individual signs within an utterance, or in remembering the correct sequence of the signs within a combination. Thus, a chimpanzee may have signed BOOK HURRY APPLE ORANGE GIMME RED GIMME YOU WASHOE THERE APPLE. Such an utterance might then later be remembered as something like HURRY YOU GIMME RED APPLE.

Memory distortions can furthermore happen because humans, being linguistic creatures, tend to remember an utterance as a linguistic one, rather than remember in full detail an unstructured, nonlinguistic sequence of signs. This focus on interpreting the chimpanzee behaviour as linguistic in nature will have played an even stronger role in the projects' participants because these humans were working in a highly fascinating project where the first great apes were being taught signs. This may have caused them to be eager and willing to see linguistic phenomena in the chimpanzees' behaviours. They may sometimes have read more linguistic aspects into what they saw than may have actually been there.[226] One way in which this may have happened is by a selective memorizing of the chimpanzee utterances. Utterances may be, consciously or unconsciously, subjectively selected because they appear to show meaningful combining. For example, a sequence like RED APPLE might be picked up and remembered as a meaningful attributive combination,

[226] Sue Savage-Rumbaugh (with Roger Lewin) gives a hint of this process when she says: "Because the intellectual excitement at uncovering languagelike faculties in apes had been intense, the pressure to overinterpret was immense" (1994, p. 7).

whereas other, less apparently meaningful sequences, such as APPLE CHASE, might be ignored or forgotten.[227]

Memory errors can be remedied to some extent by speaking into an audiotape, as was done in the Gardners' samples (see chapter 1) and was a regular method in Project Nim. However, even with audio records, the sometimes fast pace of a conversation may result in the observer not being able to immediately describe everything that happens. A period of delay may therefore occur, in which, again, errors of memory may occur. Also, sometimes the observer may be speaking into the taperecorder what has just been signed, while at the same time the chimpanzee makes several additional utterances. Reporting an observation and observing new sign utterances then take place simultaneously, leaving more room for perception and memory errors.

3. *No reliable information on human signs.*

The third problem in using individual observations is that these provide no reliable information on the signs made by the human(s). The observations focused on the signs that the chimpanzees were seen to make. Little attention was paid to the exact signs that the human(s) just made. There is thus no knowledge of the human input on the chimpanzees' signing. No discourse analyses are possible. As was admitted by Terrace (see page 129, section 2.3.), the observers were content with writing down the chimpanzee signs without accompanying these observations with information on the signs and utterances that the human interlocutor(s) had just made in the conversation. It is understandable that when these projects started, the production of signs by the chimpanzees was considered to be the most important phenomenon to record. Furthermore, as Terrace said in *Nim*, the researchers in the projects quickly noticed that the signing of their apes was not a total imitation of what the humans were just signing. Having satisfied themselves that imitation could not account for

[227] Gardner et al. (1989) specify for their second project that the following things were entered into logs "immediately if possible, but nearly always within an hour of their observation:" the PCM of the sign, "the context in which it appeared, events immediately preceding it, other signs that may have been combined with it,

the whole sign production by the apes, little attention was subsequently paid to the human input in the sign interactions.

This lack of information on the human input is maybe the worst problem of individual, unrecorded observations. Even if the signing was produced in all clarity by the chimpanzee, and there were no perception or memory errors on the part of the human observer, missing the immediate input of the ape's human interlocutor (sometimes being the observer him- or herself) makes these observations of limited use for analysis. It can not be ruled out that during the observation the ape had simply been imitating signs that the humans had just made. Such a compromising possibility then refutes the claims based on these observations of ape signing.

Another consequence of the lack of reliable information on the human input is that one cannot determine whether the chimpanzee utterance was made motivationally spontaneously or as a reaction to human prompting. The focus is on writing down the chimpanzee signs. Thus human questions and prompting of the chimpanzee's signing do not always get recorded. The situation this results in is that the records of sign utterances may be interpreted as having been motivationally spontaneous made by the chimpanzee, and later are presented in that way, whereas they may have been made in response to a human (Wh-)question or other forms of prompting.

Consider as an example the reported incident where Washoe signs HURT about her stomach. It can not be ruled out that the human may have asked Washoe several times before her utterance, YOU HURT?, besides asking WHAT WRONG WITH YOU? The human may even have pointed to Washoe's belly as she was maybe rubbing it, giving the human the idea that she might have stomach ache or something. The human may then have signed YOU HURT THERE? while pointing to Washoe's belly. Two minutes later Washoe may have signed the HURT that was reported by the observer or someone else. Rather than this being a

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and any conversational exchange that may have been part of the context" (p. 86). Though this is a good practice, it does not lead to a foolproof situation against memory errors.

spontaneous utterance on how she felt, it may thus have been an imitation.[228] In the instance where Washoe signed CRY in the Kat Beach story, there is no way of knowing anymore how spontaneous this utterance was. Kat Beach may not only have signed MY BABY DIED, but may also have signed utterances such as ME SAD, or I CRY. Washoe may have imitated the sign CRY from Kat or other people present.

A consequence of using individual observations that has not been mentioned yet regards the chimpanzees' reported vocabularies and the division of their signs into the particular kinds of semantic categories. The criterial observations to fulfill the observed and reliable sign criteria, were all individual observations and had not been filmed. This throws some doubt on the signs in the reported vocabularies. Were all of these signs really reliable and an active and integrated part of their communications with humans?

The use of anecdotes and individual observations in the projects.

Most of the data in the chimpanzee projects consist of individual observations or anecdotes. This is so for the projects of the Gardners and Fouts, as well as for that of Terrace. The field records that were set up by the Gardners, which formed the foundation for many of their conclusions, consisted solely of individual observations that were written down shortly after the fact. In the vocabulary tests, the Gardners worked with several different observers, who simultaneously recorded the signs made by the chimpanzees, though independently from each other. Though not as reliable as having a permanent record on tape or film, it was then possible to calculate interobserver reliability. The Gardners also collected comprehensive samples of the chimpanzees' signing by having a human report the signs on audiotape. Though quite a few of these samples were collected, they do not appear in their publications, except for a description of a sample for Moja (Gardner & Gardner, 1980). Some of the

[228] In the anecdote about Lucy's cat, see page 170, note that before Lucy started signing HURT, she was told by the humans that she had injured the cat's paws. So the humans may have signed HURT about the cat before Lucy's subsequent signing. Lucy's use of HURT could thus also be imitated.

signing of the chimpanzees was filmed and videotaped by the Gardners,[229] but in only one publication was such a video record used for analysis. This was in the study of sign modifications by Dar (see section 2.1.5.), where several taped hours of interaction between Dar and a human were analyzed.[230]

The Fouts also used individual observations as their source of material. In Project Loulis they also made of use of videotape and super 8 film. Two randomly selected 20 minute samples of Loulis' sign behaviour were made daily, "with one 20-minute tape available should a particularly rich communicative interaction occur at an unscheduled time" (Fouts, Hirsch & Fouts, 1982, p. 162).

Project Nim too, made limited use of permanent records such as videotaped material. Most of its data were also based on individual observations entered in the teachers' reports, though all of these were spoken into an audiotape at about the time that the observed sign use occurred. The systematic analyses of a large videotaped corpus of Nim's signing with humans, made it clear that many aspects of his sign use could be misinterpreted, or remain unobserved when relying on observations only. Indeed, Terrace and his team (1979) realized that these unexpected discoveries formed an important methodological lesson: "In the absence of a permanent record of an ape's signing, and the context in which that signing occurred, even an objectively assembled corpus of an ape's utterances does not provide a sufficient basis for drawing conclusions." They kept true to this lesson by dismissing their earlier claims on subjects like the presence of semantic relations and other regularities in Nim's combinations, since these had not been based on videotaped records.

Later, Terrace asked for the use of permanent records as a standard in ape language research, if such studies want to be of any use at all:

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[229] Several sessions of Washoe's and Dar's object sign vocabulary tests were filmed. Van Cantfort and Rimpau (1982) further mention that the Gardners gathered 30 hours of unstructured interaction on 16-mm film and about 15 hours on videotape.

[230] Eight videotapes of interactions were examined. They were recorded in nine months, when Dar was between 3:4 and 4:1 years of age. The sessions altogether spanned 105 minutes of tape.

> In view of the discoveries about the nature of Nim's signing that were made through videotape analyses, it is essential for any new project to maintain a permanent and unedited visual record of the ape's discourse with its teachers. Indeed, the absence of such documentation would make it impossible to substantiate any claims concerning the spontaneity and novelty of an ape's signing," (1983, p. 39)[231]

The results and implications of Terrace's video analysis were published for the first time in 1979. The Gardners and Fouts generally did not react by recognizing the fallible nature of individual observations.[232] Instead, their main reaction to Terrace's findings was to explain these by supposed differences in conditions between Project Nim and their own projects (see section 2.3.). Both Gardners and Fouts carried on presenting and using material that was not based on permanent records, as reliable data on the chimpanzees' sign behaviour. Later, starting with Debbi Fouts' study on chimpanzee to chimpanzee signing (1983-1985), the Fouts began to film or videotape the signing behaviour as a standard and integral part of their scientific studies. However, this has not stopped them from using anecdotes and individual observations as evidence for certain types of sign behaviour (see especially Fouts, 1997).

The problem of using non-permanent records in the form of fallible individual observations is not specific to the projects on signing chimpanzees, however. In the time that these projects started, film and video were used much less as a scientific method of

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[231] Ristau & Robbins (1982) also express the "need for a [filmed or videotaped] record in all the ape language projects" (p. 165). They say:

> Since the possibility is almost nonexistent of collecting comparable data in one's own laboratory, scientists must ask for as clear a reporting of methodology and as complete a presentation of data as possible. Transcripts of apes' and humans' signing together and unedited research films or videotapes of the apes' performance, particularly the signing apes, should be easily and inexpensively available to the scientific community. (p. 239)

[232] In an intriguing dispute in *Contemporary Psychology*, Trixie Gardner (1982a, 1982b) did not adequately respond to explicit requests from Terrace (1982a, 1982b) and Seidenberg (1982) to present non-anecdotal evidence for her chimpanzees' ability to create sentences. In 1982a she did not react at all to the request. Terrace (1982b) then responded by saying that: "Gardner continues to ignore the basic question about ape language: Is there non-anecdotal evidence that apes can create sentences?" (p. 155). In reply to Terrace, Gardner (1982b) then presented the results of the double-blind vocabulary test as "systematic evidence." However, this test was focused on individual object signs only and gave no other information, not on the other semantic categories nor on combinations. She also did not recognize the criticism that one needs analyses of large corpora instead of the

datacollection than in the current day and age. Some studies on child language development also allowed for the use of individual observations that had not been permanently recorded, such as parental reports (Braine, 1963; Nelson, 1973). At the same time, though, by the late 1960s many scientists studying child language had turned to permanent filmed or audio records as their main source of material (Bloom, 1970; Bloom, Hood & Lightbown, 1974; Bowerman, 1973a; Braine, 1976; Brown, 1973; Brown & Bellugi, 1964).

The scientists in the chimpanzee projects were genuine in their conviction that the use of individual observations was a proper method. Furthermore, there is every reason to believe that these researchers, and the teachers and companions working on the projects, meticulously and conscientiously filled in the field records and other data protocols with the details of their observations. The project leaders took great care to achieve the most accurate observations by employing qualified observers who had been trained in the correct recognition and identification of signs. The Gardners, having a behaviourist background, and centering their attention on the observable aspects of the chimpanzees' sign use, were well aware of the pitfalls and dangers of doing psychological field work. Indeed, the Gardners' stringent criteria for an observed and a reliable sign and their use of double-blind procedures in the vocabulary tests, show that the research was carried out with high standards of scientific rigour and methodology.

Of course anecdotes and individual observations have their role in science as a way to enable the discovery of new phenomena. Indeed, in nonhuman primate research it is in use as a standard method of reporting observations of new behaviours in primates (Mitchell, Thompson & Miles, 1997; Ristau & Robbins, 1982; Snowdon & Hodun, 1978; Whiten, 1991). There is nothing wrong with using anecdotes as long as one presents them clearly as such and explicitly recognizes their limited reliability.[233] Their use in scientific research is

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isolated examples as in the edited film *Teaching sign language to the chimpanzee Washoe* (see the discussion in 3.2.).

[233] In 1980 Terrace and his colleagues make an explicit distinction between material that is derived from permanent sources and anecdotal material. They include several individual observations of Nim's sign use by

thus necessarily limited. In general, what anecdotes can do is give a heuristic value of a situation, which can then lead researchers to set up systematic and reliable studies of the phenomenon. Only systematic research that goes beyond anecdotal observations can then lead to reliable data on the subject in question.

Conclusion.

Three main problems exist with using anecdotes and individual observations, that is observations that were not documented on a permanent record such as film or video. First, errors of perception can lead to misperceptions of the chimpanzee behaviour. Non-signing behaviour may be wrongly interpreted as signing. Signs can be mistakenly identified as other signs, especially with clusters of signs that are close to each other in configuration, movement and place. Sloppy signing can also lead to misidentification. The second problem is that memory errors may occur if there is some time between the observation being made and the observation being written down. The third major problem consists of the fact that these individual reports contain insufficient information on the signs that the human made in the interaction. It is therefore unknown whether some or all of the signs made by the chimpanzee were imitated from the human, nor is there information about whether the signing was motivationally spontaneous. All of these problems make individual observations and anecdotes an insufficiently reliable form of records. Their uncritical use can lead to misrepresentations of what the chimpanzees were actually signing. The resulting picture of the chimpanzee signing may be more linguistic than is justified. It is clear that for a proper judgment of the chimpanzee sign behaviour one is in need of more permanent records such as film and videotape.

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presenting them under the heading "Anecdotal observations of interesting sign use." They describe their nature as follows: "In considering our observations the reader should keep in mind their anecdotal nature. Even though each usage we will describe was reported independently by at least four of Nim's teachers, these observations were not subjected to experimental manipulation" (p. 384).

A rare admission by Fouts of the inadequate status of anecdotes occurred in O'Sullivan et al. (1982), when a conversation was described in which Washoe signed YOU GO CAR GIMME ORANGE: "The anecdotal nature of the conversation may not meet the stringent requirements on admissible data" (p. 410).

CHAPTER 3

PROBLEMS OF METHOD AND INTERPRETATION.

2. CORPORA

In this chapter the use and importance of corpora is discussed. It will be specified for the different projects to what extent corpora of chimpanzee sign utterances were collected and used. It will be shown why it is important to use corpora and why failing to base one's analyses on large enough corpora can lead to unwarranted conclusions.

Use of corpora in Project Nim.

It was the main goal of Project Nim to collect a large body or corpus of utterances by Nim. This was done by gathering and combining different corpora from two sources. The main source were the individual observations in the transcribed audio tapes of the teachers' sessions with Nim. These reports were made from the beginning of the project, and some periods were fully analyzed as a corpus. Though the teachers' reports are not the most ideal in terms of their reliability (as was just discussed in 3.1.), the other source of data was of substantial reliability. This consisted of videotapes of Nim's sign use. Using these two sources, three main corpora were eventually compiled and analyzed, resulting in systematic data on Nim's sign use in the last 26 months of Project Nim.

The corpus that was used and analyzed the most, was a large collection of spontaneously produced multi-sign utterances by Nim. The period in this corpus covered 18

months, from June 1, 1975 through February 13, 1977. It thus contained Nim's multiple-sign utterances from the time he was 18 months old up to his 38th month (Terrace, 1979a). This large corpus consisted of 19,203 combinations of two or more signs.[234] Most of the records in this corpus consisted of observations that were whispered into a miniature cassette recorder and later transcribed by the teacher. An unspecified part of it was derived from videotaped sessions of interactions between Nim and his human teachers.[235]

For the discourse analysis of the interactions between Nim and the humans, an additional 3.5 hours of nine transcribed videotaped sessions were used. These videotaped sessions were from the period when Nim was 26 to 44 months old, from February 1976 through July, 1977 (Terrace et al. 1979, 1980). The resulting videotape corpus of 585 utterances consisted of both single sign utterances as well as combinations of signs (Terrace et al., 1979).

A third large corpus was used to calculate Nim's mean length of utterances, though the exact numbers of utterances involved were not given (Terrace et al., 1980). This corpus covered a period of 19 months, starting when Nim was 26 months of age (January 1976) until the last month of the project, when he was in his 45th month (August 1977). Data for these calculations were derived from the teachers' reports (from January 1976 to February 1977), but also from videotaped sessions (for a period between February 1976 and August 1977).[236]

The total number of utterances by Nim collected in these three corpora combined was more than 20,000. The corpora provided the following detailed information on Nim's sign use throughout the last years of the project. Frequencies and the mean length of Nim's

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[234] There exist some conflicting and slightly incorrect numbers in the several publications by Terrace and his team on the corpus in question. In 1980 it is said that the corpus consisted of 19,213 utterances. However, 1980 gives Nim's correct age at the end of the period of collected corpus: Nim was 3 years and almost 3 months, so nearly 39 months in February, 1977. In Terrace (1979a) and Terrace et al. (1979) his age is stated to be 35 months. A further small difference is that 1980 gives the end-date of the corpus as February 7, rather than 13.

Also, the number of 19,203 combinations in the corpus is the total before Terrace's team applied reduction rules in which successive repetitions of the same sign were counted as only one occurrence, which thus sometimes reduced the length of the combinations (see 2.2.5. for a description of these rules).

[235] This is mentioned by Terrace in 1979a and 1983. However, in other publications it appears as if the combinations corpus is fully based on the teachers' reports only.

utterances were presented in figures.[237] The 25 most frequent types of each of the different lengths of multiple-sign combinations were presented.[238] The content and nature of these most frequent types were compared in order to best interpret the production of multiple-sign utterances by Nim (see section 2.2.5.). The distributional regularities of the position of particular signs within 2-sign utterances were also given (see section 2.2.4.1.). Terrace and his team gave an unprecedented publication of a corpus in their appendix to 1980. The full combinations corpus was listed there. The 5,235 types of combinations of two signs and more, of which the 19,203 token utterances consisted, were all presented, taking up 48 pages of the 1980 publication. Frequency information was given for each type, consisting of the number of tokens of that type within the corpus. Finally, the discourse analysis corpus was examined for the particular nature of Nim's utterances in relation to his human interlocutors' signing. Detailed information was provided on the percentages of adjacent or spontaneous utterances. Of the adjacent utterances the amount of imitations, reductions, expansions, and novel utterances in Nim's communications were calculated. Furthermore, the rate of overlap and interruption could be determined here.

Use of corpora by the Gardners.

The Gardners' field records were a large source of information on their chimpanzees' sign use. These records also included the results of the human questions posed in obligatory contexts. Further data were derived from the Sign Of the Day procedure. All of this information was used for their descriptions of the particular PCMs the chimpanzees produced

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[236] It is actually unclear whether these MLU data are partly derived from the other two corpora described in the above paragraphs, the combinations corpus and the discourse analysis corpus. In the description given in 1979 and 1980, though, it appears as if these data are derived from another, third corpus.

[237] Before application of the reduction rules (see footnote 234) the following numbers of combinations were obtained. There were 11,845 tokens of two-sign combinations, 4,294 three-sign utterances, 1,587 four-sign sequences and 1,487 combinations of five or more signs (Terrace et al., 1979). After applying the mentioned reduction rules the following numbers resulted: 9,935 two-sign combinations, 2,925 three-sign combinations, 708 four-sign utterances, and 309 tokens of sequences of five signs or more (Terrace et al., 1980).

[238] Terrace (1981, 1983) and Terrace et al. (1980) also have data derived from the teachers' reports on the rank and absolute frequencies of Nim's 25 most frequently used individual signs and single-sign utterances during five periods from between June 1, 1975 and February 7, 1977 (see section 2.1.5.).

while making the individual signs (as presented in the published vocabulary lists and Table 3.2 in 1989),[239] for their representation of the contexts in which the signs were used (also given in the various vocabulary lists and in Table 3.1 of 1989), as well as for their assignment of each sign to particular semantic categories.

Different from the Nim team's publications, though, was that exact numbers were not presented. Especially lacking were frequency data, of both individual signs and combinations of signs. Though all individual reliable signs were presented, together with the semantic category that each belongs to, the Gardners did not specify how often each particular sign was used, nor how often each different semantic category was used. For example, it sounds as if the chimpanzees were advancing into abstract terms with the acquisition of signs such as ONE, TWO, and DIFFERENT. However, with no systematic frequency information, what may have happened is that the chimpanzees pushed through the many questionings occurring to make a sign reliable, but that they did not use these signs outside of this context of the reliability fulfillment.[240] Remember in this regard the phenomenon that was found in Nim's use of signs (see section 2.1.5.). Only seven signs accounted for high percentages of his utterances. Other signs occurred very infrequently. This gave reason to think that Nim used a strategy of wild card signs. The Gardners' published information do not give the opportunity to find out whether this skewed use of signs also occurred in their chimpanzees' productions.

Also, in the Gardners' publications no information is given about the exact results of the Sign Of the Day reassessment procedure. Again this is an unfortunate omission, because large corpora of sign productions must have been amassed in carrying out this particular procedure at regular intervals.

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[239] The Gardners dedicated quite some pages to the publication of the vocabularies of their chimpanzees. Washoe's developing vocabulary was published in 1971, where the description of 85 signs took up 11 pages. In 1972, the 132 reliable signs that Washoe acquired altogether are presented in 14 pages (which same information got published in 9 pages in 1975).

[240] Connected to this omission, details have never been published on the particular successes or failures of the chimpanzees in correctly coming up with the appropriate sign in the procedure. The only information we are given is a remark that "sometimes the number of descriptions of a particular sign in a particular quarter that met all criteria for inclusion in the present summary [table 3.2] was quite small" (Gardner et al., 1989, p. 85).

Because of these shortcomings the published vocabularies of signs are less reliable as a description of the actual signs that the chimpanzees generally used. All that one can be certain about is that there were enough observations of these signs to fulfill the criteria for an observed and reliable sign.

For their study on the development of phrases in the chimpanzees' combinations of signs, the Gardners (1994a) made use of a corpus. They took seven monthly samples from the field records in a period from 6 to 60 months within the project with Moja, Tatu and Dar. This gave them a corpus of 4,601 combinations that they subsequently analyzed. Of this corpus, only several examples were presented in the text, and one figure gave the different types of combinations of two semantic categories (such as object+request, demonstrative+object), with their frequency, that the chimpanzees made in the samples. However, there was no presentation of the different tokens of the exact combinations of signs that the chimpanzees produced.

Corpora of the Wh-questions tests.

In the Gardners' various Wh-questions tests (see their description in section 2.1.4.2.) the responses of the chimpanzees resulted in several corpora of utterances. The amount of published information this resulted in, however, was considerably limited. Indeed, the way in which they were presented demonstrates the importance of publishing a full corpus, and the possibility of incorrect conclusions that can result from taking into account a small part of the chimpanzees' total utterances. A closer look at the publication in various years by the Gardners of the Wh-question corpora will now be presented.

The Washoe test on Wh-question responses (1975) contained 50 replies to each of 10 question types. The following was the information that was published about the particular responses by Washoe. She used 91 different signs in the 500 replies, which were then divided into semantic categories. 46% of her responses contained more than one sign. A few

examples of her responses were presented, such as TICKLE GUN to the question WHERE TICKLE WITH GUN? The quantitative data of how many responses were made in the appropriate target category for the particular question were then given: Washoe replied in 84% of all questions with the correct semantic category.[241]

In Van Cantfort, Gardner, and Gardner (1989) similar Wh-question results were presented for the chimpanzees in the Gardners' second project: Moja, Pili, Tatu, and Dar. In this study they periodically checked the responses of these chimpanzees to the different categories of Wh-questions, in the years from 1975 to 1981. The total corpus of replies that was collected numbered 1,297 responses. However, the same limited information on these responses was given as in the Washoe study of 1975. The signs produced by the chimpanzees were listed (as they were assigned to the semantic target categories), but there were no data on the frequency of these signs, on the combinations of these signs that occurred, nor on the appropriateness of the signs within the situational context. A few examples of replies were given, but these did not clarify the whole process, as there is no information on the representative nature of these examples. The only exact information that was given

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[241] Seidenberg & Petitto (1979) have drawn attention to the fact that such percentages may well have come about by errors in the procedure. One is that each sign was in advance assigned to a predesignated semantic category. The sign LISTEN was thus designated as a "noun" or object sign. If Washoe was then asked WHAT THAT? about a ball, and she responded by signing LISTEN, her response was considered correct. That is, Washoe correctly reacted with an object sign, which was the target category that the question WHAT THAT? should evoke. Thus, without publishing the full corpus, a contextually inappropriate response could get entered as evidence for grammatical grasp by Washoe.

A further criticism on the Wh-question tests' setup concerns the data reduction procedure that the Gardners used. All use of markers in the chimpanzees' replies were eliminated in the eventual analysis. Take as an example, the chimpanzee response GIMME APPLE in response to a WHAT THAT question. GIMME was then taken out of the response and only APPLE was considered for the determination of the correct target category. This was done because the Gardners claimed that the addition of marker signs such as GIMME did not alter the appropriateness of the response. Seidenberg and Petitto, though, see this data reduction as obscuring what the chimpanzees in effect produced in terms of utterances. Furthermore, one can question the appropriateness of certain markers: "The Gardners are forced, for example, to defend the interpretation that *Gimme Susan, Enough Susan* and *More Susan* are as appropriate in response to the question *Who she?* as are *You Susan* or *Susan there*" (p. 184). However, Van Cantfort and Rimpau (1982) looked at Washoe's original answers in the 500 Wh-question samples and reported in response to Seidenberg and Petitto, that only 39 replies contained markers. These tended to be present in replies to WHAT WANT? and WHAT NOW?, which referred more to matters of opinion rather than matters of fact. No markers were part of the replies to WHO+pronoun, WHOSE+demonstrative, WHERE+action, WHAT COLOR and WHAT THAT (for a presentation of these questions with examples, see Table 2.1. in chapter 2.1). Van Cantfort and Rimpau also showed that when the replies with markers were taken out of the sample, similar scores resulted to when they were included.

throughout this chapter then, were the numbers and percentages of chimpanzee replies within the correct target categories.

Two additional samples of the chimpanzees' Wh-question replies were analyzed in Gardner, Van Cantfort, and Gardner (1992). In the first sample, about 100 replies each by Tatu and Dar were discussed. However, again, several isolated examples were presented, but no further information was given on the exact responses, except for their adherence to the target category or not. As in 1975 and 1989, the signs that Tatu and Dar produced were presented and assigned to the different semantic target categories (called "vocabulary categories" here). For example, in Table 4 one can see that Tatu used 12 "common nouns," 2 possessives (MINE and YOURS), 3 colour signs (BLACK, ORANGE and RED), 2 materials (GLASS and METAL), 2 name signs (NAOMI and TATU), and lastly, the signs ME, COME/GIMME and THAT/THERE. Again, though, no frequency data were presented on these individual signs, nor were details given on the correctness of the production of these signs in each particular context.[242]

In the second sample analyzed in 1992, though, the Gardners finally analyze the factual correctness of the replies for a total number of 16 for Tatu, and 27 for Dar.[243] Still, though, the exact responses were not given, but only the totals: 14 out of Tatu's 16 replies were factually correct, and Dar was correct in 21 out of his 27 replies. In a further table a

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[242] Further obstruction of the possibility to determine what exactly was signed in the chimpanzee responses comes about by particular rules that were used in the tests' analyses. One of these consisted of reducing a reply with two signs from the same target category as a functionally correct response within the same category. The example was given of the reply ORANGE BLACK: both are colour signs, so the chimpanzee responded by using the color category. However, such multiple sign replies were then impossible to recover in the quantitative data on the amount and percentage of replies within the correct target categories. The Gardners themselves admitted that maybe the chimpanzees were guessing in such a multiple answer. But they said that this was not relevant for their research question here, as they were analyzing the chimpanzees' replies "for appropriateness to the questions rather than for factual accuracy" (p. 43).

[243] It is interesting that only in 1992 they analyze a small subset of replies for factual correctness. Up till then the Gardners had not undertaken such an analysis. This was for two reasons. First, they felt that replying with the correct semantic target category was "in some respects more significant" than giving replies that were factually correct. For example, responding to a WHO THAT? question in the context of Roger Fouts, by "incorrect name signs such *Susan* or *Greg* [when it had to be ROGER] were still correct in a way that replies such as *Hat* or *Black* or *Tickle me* were not" (1975, p. 248). The second reason was that certain Wh-questions, the questions WHO GOOD? and WHAT YOU WANT?, could not be given a reply that was either factually correct or incorrect. These questions dealt with matters of opinion and preference instead of fact, so the only objective judgment possible, according to the Gardners, was an analysis of the proper semantic categories in response to these.

small sample of the older material of Wh-question tests was examined for factually correct and incorrect replies. The numbers showed that Washoe was correct in 24 out of 26 replies, Moja in 26 out of 36, Tatu in 9 out of 11, and Dar in 9 out of 13. The last information presented was that Tatu and Dar produced the most factually correct answers in response to WHAT THAT questions, and the overall percentage of replying with factually correct signs was 84% for Tatu and 70% for Dar.

With no further published corpus of Wh-question replies, there is no way to further assess the results from these tests. Even though the exact responses were present in the raw data used for these publications, there is no information on the frequency of the individual signs in the responses, what signs were made after which question, in what context the sign or combination of signs were made, and how well the response fitted the context. Because of this missed opportunity one also does not know how routine-like or maybe stereotypical the chimpanzee responses to the several different Wh-questions may have been. There is no way to know if, for example, the chimpanzees may have always signed their own name sign in response to a WHO question, and similar routines for the other questions. And even if they sometimes signed YOU or some other name sign, did that make sense in the context? With no additional information, the answers to these relevant questions remain unknown.[244]

There was one time that the Gardners published more information on the corpus. This was in 1974a, which was actually the first time they mentioned the Wh-question procedure. Here a small corpus of 44 exact replies by Washoe is presented in a table, though unfortunately there is no context information nor an assessment of factual correctness of the replies. The replies were made in response to WHOSE THAT?, WHAT THAT? and WHAT COLOR? questions. This provision of part of the actual corpus then immediately shows

[244] Other methodological criticisms are possible on the particular procedure and rules used in these studies (Seidenberg & Petitto, 1979; Wallman, 1992). One problem is that many of the questions could have been appropriately answered by the chimpanzee by simply taking the context into account, without paying attention to the particular question type. For example, if the humans asked WHO ME or WHO THAT by pointing to a person or a picture of a person, the chimpanzee could respond with a person sign regardless of the presence of the particular interrogative sign WHO. A point to the picture or person by the human, combined with a questioning expression, would indeed be enough for the chimpanzee to grasp that it was to give a name sign.

several noticeable things. One is the high incidence of the reply MINE to the question WHOSE THAT?: 9 out of 14 times (three times YOURS was signed and once the combination MINE YOURS). This makes one wonder how often in general the sign MINE was made in response to the WHOSE question. That is, another routine may have been acquired here, having come about because of usefulness. Signing MINE will probably have resulted in the human agreeing that some object was the chimpanzee's and the human may then have more quickly given the object to the chimpanzee.

The 1974 corpus also provides interesting replies to the WHAT COLOR? question. RED occurred often, in nine out of the fifteen replies.[245] Eight replies consisted of multiple-sign utterances. Five of these were pairings of different colours, making them look like guess work. Washoe signed RED BLACK 3x, 1x WHITE BLACK and once she even produced RED WHITE GREEN. Then there were BLACK COW, WHITE CLOTHES, and lastly FRUIT CHEESE. Because there are no data on the correctness of the responses, what may have happened in the daily drilling by asking the obligatory questions, is an association of certain colour signs with the WHAT COLOR? question.[246] Seidenberg and Petitto (1979), and Wallman (1992) also mention this possibility: Washoe "could answer a question by learning to associate a single target sign with a wh-sign" (p. 204), which they do not consider that difficult considering the intensive training that Washoe and other apes received. Indeed, Seidenberg (1986) says "it insults the intelligence of the animal to think it would not latch upon" this strategy (p. 40).

It was Seidenberg (1986) who eventually analyzed in detail the corpus of the Washoe test and provided the kind of information that is crucial in order to make a better judgment of

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[245] Of the colour signs in the chimpanzees' vocabularies the sign RED is closest in configuration to the sign COLOR. The PCM of the chimpanzees' RED was an extended index (from a fist, sometimes pointed up) rubbing (repeatedly) down the lips (or chin). The humans used the ASL COLOR sign, which is made by wiggling the five upward pointing fingers of the hand in front of the chin. Thus, rather than signing RED Washoe may have been attempting to imitate the human COLOR sign.

[246] Braine (1976) has an interesting observation on his son Jonathan's use of colour terms that is of relevance here. Jonathan used combinations with a colour term as a routine in which usually an incorrect colour was added to an object term. He would say "red car" of a blue car. When an adult would correct him, Jonathan would then

the Wh-tests. He asked for all the unpublished data (questions as well as responses) from Washoe's test and was provided with these by the Gardners. The results of his independent analysis confirmed the hypothesis that Washoe based her answers on a simple association of certain specific signs with each particular question frame, rather than that she grasped the meaning of the human interrogative signs. In 71% of her responses to WHO THAT? questions Washoe used one of three signs: ROGER, WASHOE or YOU. WHO+action questions were answered with YOU or ME in 75% of the cases, which two signs were also produced in 58% of her replies to WHO+trait questions. Taking these three types of WHO-questions together, the four signs ROGER, WASHOE, YOU and ME, accounted for 83% of all correct responses. A similar pattern was found for the other question frames. When asked WHAT NOW? 82% of her responses contained TIME, as in the example TIME EAT. WHOSE THAT? questions were only answered by YOURS or MINE. Two exceptions to this pattern were Washoe's answers to WHAT WANT? and WHAT THAT? Here she produced less stereotypic responses. However, her strategy to these questions was to name a food in response to WHAT WANT? and to label an object as a reply to WHAT THAT? questions. Having finished this corpus analysis, Seidenberg remarked that "these data present a very different picture of her ability to answer questions than in the [Gardners'] 1975 project" (p. 41).

This discussion of the Wh-question tests shows how important it is to provide a more or less complete and exhaustive picture of the corpora of replies that were gathered. Limiting the analysis of the corpus to the percentage of correct replies in the target semantic category led to the conclusion that the chimpanzees have a grasp of sentence constituents (see section 2.1.4.2.). However, a full analysis of the corpus resulted in the discovery that the chimpanzees had associated in a routine way only several particular signs to each interrogative sign.

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repeat "blue car." Then he continued the routine by using the same colour word for another object, irrespective of whether it was right. He could say "blue block" for a green one.

Use of corpora by the Fouts.

Although the Fouts relied to some extent on anecdotes of individual observations, they also accumulated corpora. In the early publications of the Fouts, the conceptualization study with Lucy and the study in which Ally was taught signs for spoken words which he later had to transfer to the words' referents, stands out in its publication of the test corpus. Table 2 of Fouts (1975a) listed all of Lucy's utterances with which she named the different fruits and vegetables. For each of the 24 different edibles her responses during 12 training sessions were included. As for the Ally study, table 4 of Fouts, Chown, and Goodin (1976) presented a complete list of hundreds of his responses to the target objects. Especially since the Fouts started collecting data by use of remotely controlled videocameras in the 1980s, graduate and Ph.D. students collecting their data in Ellensburg usually amassed a large corpus of chimpanzee utterances on film or videotape that were later transcribed in detail. The contents of these corpora, however, were usually not published in detail. In general, what was presented were only the relevant numbers and percentages that answered the research question(s) of the particular study. Just as the Gardners only looked at certain aspects within the corpus (such as the use of the appropriate semantic target category in response to Wh-questions), the Fouts and their coworkers generally did not present details about the particular signs, utterance types and tokens, and their frequencies (see the criticisms of the Kennerud, Bodamer and Jensvold studies in chapter 3.4.). The private signing studies by Mark Bodamer, however, stand out in their full presentation of the complete corpus of utterances detected on the numerous hours of videotape that were analyzed for this behaviour. As was mentioned in section 2.1.5., in Bodamer, Fouts, Fouts, and Jensvold (1994) Table 4 lists all the instances of privately signed utterances, with for each utterance its frequency and the chimpanzee subject who produced it.

Chimpanzee to chimpanzee signing.

The corpora collected for the Fouts' studies on the signing of the chimpanzees amongst themselves were published in a limited manner. Take as an example the 1984 publication of the Fouts and Schoenfeld study on the subject. There is very little information on the procedure with which the utterances were grouped into the six behaviour contexts (for more information on this subject see section 2.4.7.). There is only summary information on the signs used and the nature of what were called "conversations." What was published in the 1984 article was that HURRY was the most frequent sign found in all behaviour contexts, except for the contexts "play" and "discipline." CHASE was the most frequent sign in the play context, "which is the name of the most frequent game of Dar and Loulis" (p. 10). The only further mentioning of signs used in the chimpanzee interactions was the sign HUG. In section 2.1.5., it was already mentioned that Moja produced this sign in one month in a total of 211 times towards Dar "during maximum tumescence" (p. 8). The only actual example of a "conversation" that was given in 1984 concerned the use of HUG in a reassurance context. It was actually the "conversation" with the biggest number of signed turns (5) that was found. It is represented here in full:

> Dar had just sneezed on Washoe, who responded by threatening Dar, who whimpered and retreated from her. The signing then occurred as follows:
>
> Washoe (to Dar): HUG
>
> Dar: HUG (approaching Washoe)
>
> Washoe: HUG
>
> Dar: (approaches and sits next to her): HUG HUG
>
> Washoe: HUG, COME HUG
>
> (Dar and Washoe embrace, ventral-ventral) (p. 10)

Publishing 5200 interactions may have taken up too much space, but they need not have published every interaction. They might have looked for certain types of interaction that

occurred again and again and thus reduced the amount of material to publish the corpus by giving the frequencies of these types. Without exact details of the so-called "conversations," we are left to guess about the nature of the chimp-to-chimp signing.

The information thus presented in 1984 does not allow for a clear picture of this phenomenon. This same situation occurs in the later analysis of chimpanzee-to-chimpanzee signing collected in the remote videotape study (D. Fouts, 1989, 1994; Fouts & Fouts, 1989; see section 2.4.7.). Utterances were grouped into behaviour contexts, and some examples were given (amongst which Loulis' most frequent signs). However, without a detailed presentation of the actual corpus of chimpanzee sign interactions, there is not enough information to assess this phenomenon well enough.

Problems of insufficient corpora in the analysis of combinations of signs.

To determine the semantic structure of sentences or phrases in the form of semantic relations, the collection and analysis of large corpora of utterances is a necessary requirement as well (Bowerman 1973a, Braine, 1976). This is because, for semantic relations to be present, it must be the case that they are expressed by a large variety of words or signs and not just by one single instance. Say a child called Eve makes the utterance "Eve eat." This might be an instance of the Agent+action relation, expressing the action of eating by the agent Eve. However, if Eve never makes other Agent+action combinations, such as "Adam eat", or "Mommy drink", it might not be the case that "Eve eat" is an actual expression of a semantic relation. It might be a coincidental juxtaposition or haphazard concatenation of two further unrelated words. Or it might be a habit or routine that she has developed because the phrase always causes her caretakers to give her a snack (see Bowerman, 1973a; Terrace et al., 1980). In such a case "Eve eat" could be exchangeable with a command like "Food!" Children are known to use stereotype expressions that may consist of several words. Nelson (1973) gives the examples of phrases such as "stop it," "don't do it," and "I want it." These were

stereotypical in that not all words occurred separately in one-word utterances, but generally in these particular combinations only (this was especially so for the function word "it"). No evidence therefore exists that each of the words in this combination is understood as a separate meaningful entity.[247]

In their analysis of semantic relations in the chimpanzees' combinations the Gardners did not publish the corpus on which they based their conclusions. Their 1971 presentation of the subject was based on a corpus of 294 two-sign combinations. However, only 22 of these were presented in a table. The other 272 were undetectable within the publication. In the case of assessing semantic relations, however, the absence of the corpus is even more problematic. This is because in order to determine their presence one needs to make use of a process of semantic interpretation, in which the context of the utterance is taken into account. With the absence of publication of all 294 two-sign combinations together with their contextual information, there is no way to judge the Gardners' interpretations.[248] In order to better judge the assignment of combinations to meaningful patterns, it is of pivotal importance that all combinations with context notes are given in a corpus of the human-chimpanzee interactions.[249] Critics such as Seidenberg and Petitto had already pointed this out, but the Gardners did not respond with publication of the complete corpora.

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[247] The child David in Braine (1976) also has combinations where "it" appears to have no real meaning, but is part of an associatively learned pattern, as in "fix it that" and "help it," the latter meaning "help me." Brown (1973) mentions one child's early "piece of toast" and "drink of water" as rigid phrases that had no variants and were probably long words with no internal structure. All of these are called "prefabricated routines" and usually involve the functor words seen in the examples. Dromi (1999) reports the following on the subject: "During the one-word stage children might occasionally produce multi-word combinations that do not yet reflect productive syntactic abilities. Such expressions often directly derive from the input to the child, and are, in fact, unanalysed speech routines (e.g., "what's this" or "daddy went to work")" (p. 100). Tomasello & Brooks (1999) also draw attention to the presence of what they call "frozen phrases" in almost all children's early speech and give the examples: "I-wanna-do-it", "Lemme-see", and "Where-the-bottle". See also De Villiers and De Villiers (1986) on learned routine combinations used as unanalyzed wholes.

[248] Their 1978 and 1980 publications' on the chimpanzees' combinations (when they mention the percentages of 74 to 90 percent fitting the semantic relations) also lack a corpus that allows an independent verification of the categorization into semantic relations.

[249] An example of a maybe problematic interpretation of a two-sign combination that cannot be judged without being able to relate the utterance to the whole corpus of utterances and context information, is the classification of GIMME DRINK as an instance of the action-object relation (1980). Instead of this relation, it may just be a clear example of adding a request marker to an item the chimpanzee desires. However, if the Gardners classified this instance as representing action with an object, then one does not know how many request utterances such as these were eventually assigned to a maybe improper category.

In their 1994 publication on phrases the Gardners again claimed that semantic relations are present in the chimpanzees' combinations. However, as in their earlier publications on this subject, they presented only a few examples in a table which applied the child semantic relations to the chimpanzee utterances. Examples were ME OPEN and TATU DRINK as instances of the Agent+action relation. DRINK SODAPOP and EAT APPLE were presented as examples of the Object+action relationship. Examples of the Attributive relationship were: BLACK DOG and RED TOOTHBRUSH.[250] These all sound to be meaningful combinations that express a relation between the semantic roles of the combined signs. However, without presentation of the corpus and knowledge of all the different types of combinations found, there is no way of knowing what percentage made sense and how many where less plausible as meaningful combinations. Picking out a few examples that sound well and appear to be good instances of the phenomenon in question, without providing a further presentation of the whole corpus, leads to the impression that all combinations were of the kind presented in the examples, when in effect this may not have been the case.[251] Seidenberg (1983, 1986) invented a term for this particular practice. He called it the employment of the *consistency criterion.* It amounts to only citing examples that are consistent with a linguistic interpretation of the apes' behaviour. This is a selective presentation, though, and does not allow for an assessment of non-linguistic interpretations "because the relevant data were not presented. In other words, the linguistic interpretation of these examples could not be falsified" (p. 36). Seidenberg's verdict is that because of this practice "ape language research departed from the normal process of scientific inquiry in a profound way." He also says that "the absence of any attempt to systematically address the

[250] For all examples given in 1994a, see Table 4 on page 241.

[251] The situation this brings the Gardners in, is committing the mistake they accused others of when representing the semantic structure of combinations. They criticized Brown's use of rich interpretation, especially because he "has not yet published a full list of utterances and contextual notes, the reader cannot decide for himself, except from the selected examples" (1974, p. 732).

many non-linguistic interpretations of ape signing is the single most devastating failure of the ape language research" (p. 36).[252]

This same practice of a possibly selective presentation also occurs when the Gardners (1994a) present their new, less interpretative method of classifying combinations as semantic relations, which will be presented in chapter 3.4. In this method they assigned each sign to one semantic category only. Two-sign combinations were then represented as phrase patterns in which two semantic roles were combined, such as object+action and agent+action. Without taking further contextual information of these utterances into account, these were then seen as the expression of semantic relations. This automatic, mechanical and decontextualized way of assigning combinations of signs to semantic relations replaces a straightforward discussion of the combinations with all the available contextual information. Nonsense combinations that are not meaningfully related can enter the mechanical procedure of classification and can not be recovered in the published data. Only the sensible examples are then published, but there is no information on the total corpus of original combinations.[253]

The Gardners also do not provide corpus information on the individual signs within the combinations. That is, a corpus of these signs when they are used singly in 1-sign utterances. Such knowledge needs to be part of one's interpretation of multiple sign combinations. The general use of individual signs can make one discover the most probable function or meaning of each separate individual sign within the combination. For example, it may be the case that the sign HOT, besides functioning as a description of a quality, is also used in 1-sign HOT utterances to request a hot drink. In such a situation, HOT could also

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[252] Wallman (1992) also criticizes the way in which sign utterances were analyzed by the Gardners and others: "The ape researchers, ..., could be described as having fixated on certain of these criteria [of linguistic ability, *ER*], generally the most mechanical and readily quantified, and then having either expressly trained them or searched them out in their data" (p. 106).

[253] The Gardners arrived at this new method because of their criticisms of the use of rich interpretation (see its further discussion in chapter 3.4.). These can actually be applied in an inverse way to their own new method. The Gardners criticized Chomskian accounts of language development that claimed that syntax starts to develop early, by stating that "in the method of rich interpretation ... the syntactical imagination of the investigator replaces straightforward reports of what children actually say. In most cases, the original observations are so layered over with rich interpretation that they can never be recovered" (1994, p. 251). Though the Gardners

function as an object term for hot drinks. This knowledge that HOT sometimes also refers to objects, would then be important for the assessment of semantic relations. Consider a sequence such as HOT FOOD. Such a combination need now not automatically point to an attributive relation, referring to food that is hot. Instead it may simply be that the chimpanzee was requesting two objects, a hot drink, and food. In the latter possibility no structure in the form of an attributive semantic relation between the two signs would need to be assumed.

The absence of sufficient corpus information also lessens the power of published examples of creative combinations. The first problem with these examples, is that one doesn't know how incidental the creative combination is.[254] When Moja signed METAL HOT, this was interpreted to be a meaningful, intentional combination to name a lighter. What is unknown, though, is whether she was producing a few signs only to please the humans, which were then interpreted by the humans to be meaningfully related. If on later occasions Moja would continue to call the lighter METAL HOT, in sign utterances such as ME SMOKE GIMME METAL HOT, or THAT RED METAL HOT (for a red lighter), the interpretation of the combination as a meaningful one would be stronger.[255]

The other problem is that without information on the general use of the signs within these combinations one cannot assess whether the combination may in fact only be a sequence of two unrelated signs (Seidenberg & Petitto, 1979, 1981; Wallman, 1992).[256]

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refrained from any interpretation in their new method, the result of their procedure was similar to that of the criticized Chomskian analyses.

[254] Seidenberg (1986) says that when a chimpanzee always produces sign combinations without meaningful structure, eventually "a number of 'creative' utterances fall out of this process, as does a lot of word salad" (p. 35). Creative combinations would thus be sounding nicely only by accident. Analysis of corpora, however, would show that they were only coincidental pairings and not intentionally meaningfully combined by the chimpanzee.

[255] Of course, the humans would have to refrain from showing that they are delighted and impressed at observing the creative combination. Otherwise the praise and approval with which the humans would respond could reinforce the particular combination as an approval-getter from the humans only, without the chimpanzee having the intention to describe something by creatively putting signs together. For example, Fouts claims that Washoe signed WATER BIRD frequently to describe swans. One can imagine, though, the delight that Fouts had in observing this particular combination, thereby reinforcing Washoe to make it again and again (M. Gardner, 1981; Ristau & Robbins, 1982).

[256] In the conceptualization study Lucy signed CRY HURT FOOD for a radish that she did not like. In fact, Lucy made this combination only once. Her descriptions of the vegetable on the first three days were THAT LUCY FRUIT, DRINK FOOD, and LUCY LUCY FOOD, respectively. On the fourth day, she took a bite of it and then spit it out. Asked to describe the radish now, she signed CRY HURT FOOD. In the eight following days the combination did not return, though the signs CRY and HURT were part of her response in four

Seidenberg & Petitto (1979) explain that a large corpus is the only way to assess a possibly interesting combination such as WATER BIRD. A thorough analysis of an extensive corpus might for example show that the signing apes frequently combine the signs WATER and BIRD with other signs in apparently meaningless combinations such as WATER SHOE, WATER BANANA and COOKIE BIRD. In the presence of these unrelated sequences of signs, a combination such as WATER BIRD would lose its significance.[257] Strikingly, the published corpus of Ally's responses in the transfer study (Fouts, Chown & Goodin, 1976) totally proves this point. The situation Ally was in was exactly the same as Washoe: both had

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subsequent days. Her signs for radish on these last eight days were: HURT DRINK, HURT, THAT FOOD, CRY, SMELL, FRUIT, THAT SMELL FRUIT, and SMELL HURT. Taking all of these responses together, lessens the strength of the interpretation of Lucy's description of a radish as a structured *CRY HURT FOOD*.

Upon further examination, all the published examples of creative combinations (presented in 2.2.3.) may be explained in such a way. All of the signs would be appropriate to the object, but there would be no necessity to see all these signs as being meant to be related to each other. Consider the other instances:

- Washoe's OPEN FOOD DRINK for refrigerator. If this is what Washoe signed whenever the humans asked her WHAT THAT? while pointing to the refrigerator, all that may have happened is that Washoe was requesting something to eat or drink from the fridge, as the three-sign combination can easily be interpreted as a simple request. Even Washoe signing OPEN FOOD DRINK spontaneously (so without any question asked by the human) while looking at the refrigerator, might still be Washoe requesting things from the fridge, rather than her creatively naming the fridge.
- Washoe's DIRTY GOOD for her toilet. Both signs are relevant to the situation of a toilet, so without further information one can not decide that this is a creative combination. One can imagine that the humans were surprised by this particular pairing of signs, interpreting it humanly as a funny way of describing the toilet. This may then have caused the humans to react very strongly to the coincidental pairing, their praise and pleasedness reinforcing Washoe to make the combination again (see also Umiker-Sebeok & Sebeok, 1980).
- Moja's LISTEN DRINK for a glass of Alka-Seltzer. Washoe had signed LISTEN DOG when she heard the sound of a dog, a combination she had learned from the humans (Gardner & Gardner, 1971). So, rather than making a meaningful combination with which Moja intends to name the Alka-Seltzer, as in *A LISTEN DRINK*, she may just be signing that there is a sound and that there is a drink. Two unrelated signs thus, in the same way as LISTEN DOG would not be a "name" for barking dogs.
- Lucy's CANDY DRINK for a quarter piece of watermelon. This was her description on day 5, 9 and 11 of the conceptualization study. Once she signed DRINK FRUIT and on another day FRUIT DRINK. On four other days she signed DRINK, and on the three remaining days she responded with THAT DRINK.
- Washoe's GIMME ROCK BERRY for Brazil nuts. Further doubt about this combination can be the fact that at the time that Washoe produced it, she had only recently learned the sign for ROCK (Fouts et al., 1989). Besides all the other alternative explanations mentioned above, this may simply have been an error on Washoe's part in trying to find the right sign for the nuts.

[257] Seidenberg & Petitto (1981) add the following remark about the supposed creative combinations: "In conjunction with a corpus, these might constitute representative examples of the apes' behaviors. Lacking a corpus, their typicality cannot be established, nor can alternate, nonlinguistic interpretations be eliminated, for example, that they were the output of a random sign-generation process which produced a few interpretable sequences amid a large amount of noise" (p. 116-117).

Ristau & Robbins (1982) put it thus: "One needs a statistical analysis of word combinations and error frequencies drawn from an appropriate, unbiased sample of the ape's productions in order to evaluate the significance of the "creative naming"... If, e.g., the majority of word combinations are nonsensical, then the few meaningful ones that are reported are completely inappropriate samples and should not be considered within the realm of scientific evidence" (p. 194).

Van der Zee (1991) similarly argues for a corpus as the only way to be able to interpret WATER BIRD. Without it, it may have been the case that Washoe had been asked 500 times what the swan was. She might have given 499 times a different, incomprehensible answer, and only once WATER BIRD.

to label objects they had not yet learned a sign for. The Ally corpus shows many apparently meaningless combinations. Thus, amongst Ally's signs for a banana were STRING WATER, WATER PIN, BANANA WATER, WATER FOOD and STRING PIPE BIRD; for water: CHAIR WATER, PIPE DRINK and SPOON WATER; for a leaf: TOOTHBRUSH STRING DRINK and NUT STRING FECES MOTHER; for a nut: TICKLE LARRY and FECES LISTEN; for a raisin: LISTEN PHONE LOOK TOOTHBRUSH FOOT. The actual presence of these unrelated sign sequences in one of the signing chimpanzees demonstrates the necessity of corpus publication to arrive at the most plausible characterization of the chimpanzees' sign combinations.

The same problem of too little information shows up at the other conclusions on combinations that the Gardners draw. There is no way of knowing anymore whether their conclusions on the grammatical aspects of their combinations were correct, nor is it clear whether longer utterances increased the actual information content of the utterances. Unless an extensive corpus of the chimpanzees' sign use still gets published, recorded on film or video, the published information is not sufficient as proof for the opinion that chimpanzees combine signs in a structured, meaningful way.[258]

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[258] In a large review article on the controversy on signing apes, the Gardners' graduate students and co-workers Thomas Van Cantfort and James Rimpau (1982) defend the manner in which the Gardners presented the sign use of their chimpanzees. They say that the Gardners are no exception in omitting to publish large corpora of utterances. Raw data rarely get published, and it is common practice to publish a summary of one's data together with some illustrative examples. They present some reviews of linguistic studies that show that the total corpora of utterances hardly ever get published.

It is true that not all raw data of a scientific study normally get published (though large corpora on child language have been published (Bowerman, 1973a, 1974; Braine, 1976)). However, Van Cantfort and Rimpau do not appear to grasp the reasons why the critics asked for publication of extensive enough corpora of ape sign utterances. The systematic analysis of a large corpus on film in Project Nim showed a lot of phenomena that threw a quite different light on what the researchers first had thought of Nim's signing. Corpus analysis of both his individual signs and his combinations showed that his sign use was much more limited than the utterances of human children. Furthermore, the corpus analysis resulted in finding out about the pivotal role of imitation in Nim's conversations with the humans. Van Cantfort and Rimpau do not react to these findings by presenting corpora of the Gardners' projects whose analysis shows a clear and different picture from the sign use of Nim. Instead, their response to the critics is a disqualifying one. Their reaction is that as it is not an overall practice to work with and publish large corpora, this should not be held against the Gardners. Rather than facing the questions and objections that result from the absence of (published) corpora, they avoid the important and far-reaching consequences of Project Nim's corpus analyses.

A last thing that Van Cantfort and Rimpau have no consideration for, is the not unjustified demand for large corpora of ape utterances while the same standards may not always be asked of child language acquisition studies. Because the signing ape projects studied the only signing apes available, and the whole setup was to discover whether their sign use was subject to similar processes as in child language, it required the analysis and

Corpora and communicative intentions.

In Project Nim, only the Sanders (1985) study explicitly coded Nim's utterances for communicative intentions. A large corpus of 578 nonimitative utterances was analyzed for what was called purpose or motive. This showed a great predominance of requests in Nim's signing. Though it is unclear whether the results of Sanders' study were already available at the time when the Nim team published its first and major articles (1979-1980), the other corpora analyses gave numerous data that justified the characterization of Nim's signing as "acquisitive." The detailed information on the more than 20,000 utterances altogether show that most of these are easily interpretable as requests in one way or another. Data on the topic or content of the utterances and the comparison of the different lengths of utterances with each other foster an interpretation that Nim's major preoccupation was to state requests and make clear to the humans that he wanted something from them. Furthermore, the discovered prevalence of imitation shows a lack of intrinsic motivation in using signs for their own sake. Also, the uninformative stringing in Nim's combinations of signs, with its characteristic use of repetition and redundancy to emphasize his message, strongly confirms the idea that his main intention is to request things through the use of signs.

As for the claims by the Gardners and Fouts on the communicative intentions of their chimpanzees' utterances, again, there are no corpus publications that confirm these statements. Their claim that the chimpanzees' signing went beyond making requests and included making comments and giving descriptions, gives the reader the impression that non-

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publication of large corpora, maybe even larger than in general practice, in order to get the best assessment of the behaviour. Indeed, Seidenberg and Petitto (1981) state that it is in "a limited sense" justified to require "more complete and more rigorous" data on ape subjects in ape language research than is the rule in data collection on children in child language research. They present two reasons. One is that the access to the ape data is not easy as only a small group of people are carrying out the work. This is not the same in child language research, where many researchers can easily study children and thus independently verify the results of others. Therefore it is "the ape researchers' primary responsibility ... to provide a full characterization of their behavior regardless of the interpretation assigned to it" (p. 125). Another reason they give is that it is appropriate to use the "most robust data" and "stringent" criteria of investigation when the claims at hand are "unusual, implausible, or controversial." This is the case with ape language, as it has been with ESP or the debate on

requesting sign use took place to a considerable extent. However, without systematic information coming from corpus analyses there is no way of knowing how frequently this happened. Nor is there indeed a way to double-check the justifiability of interpreting certain utterances as a comment, or as uttering something more than just a request.

The same situation holds for the Fouts' claim that the chimpanzees use signs to relate their emotions, feelings and thoughts, including making derogatory remarks and insults. No systematic data are given based on large corpora. Consider the use of the sign DIRTY. A big enough corpus could have been collected of the use of DIRTY, on film or videotape, with sufficient additional notes on context and further situational aspects. Would DIRTY then regularly be used in situations where the context indeed made an interpretation as an insult plausible, the anecdotes' interpretation would have been less unwarranted. Regular utterances might have been found such as YOU DIRTY NOT PLAY NOW, or LOULIS DIRTY EAT FOOD DAR, which would have given plausibility to an insulting use of signs.

The same holds for signs such as HUG/LOVE, CRY, and HURT. A systematic analysis of a substantial corpus of the use of these signs was not carried out. These signs were nevertheless interpreted as references to feelings of love and other affective states. Furthermore, this interpretation did not only show up unwarrantedly in the anecdotes presented as proof of the chimpanzees talking about their inner feelings, but also entered the systematic analyses of private signing by Bodamer (1987; Fouts et al., 1991, 1994). Without a proper justification based on corpus analysis, all utterances with DIRTY or HUG/LOVE in these studies were automatically designated as instances of the Expressive category. The only thing that is said about this decision is that DIRTY "is used by Washoe for things that she does not like. Instead of signing "I do not like this" or "I am mad," Washoe would sign DIRTY DIRTY DIRTY DIRTY loudly and repeatedly" (p. 21). Nothing is said about the emotional reference of the HUG/LOVE sign. To assign all chimpanzee utterances with

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inherence of intelligence. Applying just any method from child language research might not provide the best of data.

HUG/LOVE automatically to this category is an unjustified procedure. In the absence of corpus information, the use of these unsubstantiated rules leads to conclusions that may not correctly reflect the functions that the private signing has for the chimpanzees.[259]

Conclusion.

The use of systematic corpora of sign use is of utmost importance in ape language research. Without substantial corpora available, actual conclusions cannot be drawn about the nature of ape signing behaviour. In the absence of a published corpus one can not determine the representativeness of sign utterances that are presented as examples. This is especially so for combinations of signs. It may be that the examples were lucky coincidences that had a linguistic look. A corpus, however, may show that the combinations generally do not contain a meaningful structure. Also, systematic information on single-sign utterances may have implications for combinations, in that these may have been sequences of unrelated signs. Use and publication of large corpora is therefore another necessity for a correct interpretation of chimpanzee sign behaviour.

[259] Note the contrast here between Bodamer collecting and publishing corpora of private signing, while at the same time using rules for categorization that in themselves have not been backed up or justified by corpora analyses.

CHAPTER 3

PROBLEMS OF METHOD AND INTERPRETATION.

3. DRILL AND PROMPTING.

In this section on the methodology of the projects, the focus is on the ways the humans treated the chimpanzees and interacted with them. There is a concern that the human teachers and companions of the chimpanzees made considerable use of drill and enforcement of sign production. This will have been done with the genuine conviction that drill was one of several useful teaching methods. However, its use may have depressed an intrinsic interest in sign production on the side of the chimpanzees. It may have resulted in the chimpanzees making signs in order to please the humans and fulfill their demand to produce signs. The use of many routine sign interactions, such as the question-and-answer patterns in the obligatory contexts used by the Gardners, may have led to the production of signs by the chimpanzees as a learned routine rather than as a meaningful exchange of information.

The projects with signing apes were forcing behaviours onto the ape subjects as a matter of principle. The apes were acquired for the sole purpose of serving as experimental animals in ape language research. They were not asked for their consent to participate, but were held under the researchers' custody and forced to undergo all procedures of the projects. This does not mean that the apes were treated without care and affection. A human child is similarly under its parents' custody and is not allowed a free choice in every situation either.

However, in a human child-parent interaction the child itself appears to show a clear interest in learning human language (Clark, 1993; Goodluck, 1991). Its parents will desire and expect that their child will develop language and they will aid the child from its entrance into the family by talking to it and using language in a playful sense. With the signing apes, however, the situation was inevitably somewhat different. In signing to their apes and amongst themselves, the researchers behaved like human parents. It is in the forcing of participation during "ASL lessons"[260] and other sign instruction or assessment procedures such as the obligatory contexts, that the major difference in treatment lies in comparison with human parent-child relationships.[261] Furthermore, the attitude that parents have towards their children is probably different from the attitude the researchers had towards their ape subjects. Though parents have expectations about their children, such as wanting them to grow up as competent or even erudite language users, the ape researchers and their co-workers will have had more intense expectations of the apes' achievements.[262] As mentioned several times now,

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[260] Relevant here is the fact that in the study on Tatu and Dar's reaction to the announcements of positive or negative events (Gardner, Gardner & Drumm, 1989), lessons in ASL were rated not that positively by their human companions. These humans had to rate events according to their impressions of the positive or negative affective charge the event had for the chimpanzee. Lessons in ASL rated 3.5 for Tatu, and 3 for Dar, on a scale of 1 (most negative) to 7 (most positive).

[261] Wallman (1992) describes the teaching of signs to apes as "employing years of tutelage far more intense than that experienced by most children" (p. 4). Hewes (1973) also says that the sign language experiments with apes could only have been done with "highly motivated instruction," different from parents with their child, where the child acquires language in a "teach-yourself situation with surprisingly little explicit adult 'instruction.' .... On the basis of the data so far, it seems that chimpanzees would pick up very little ASL or any other feasible language if they were merely exposed to it in the way that most human children are" (p. 131).

In an excellent and extensive discussion of the problems and pitfalls of the research on communication with other animals, Umiker-Sebeok and Sebeok (1980) note that all ape language projects are forms of interspecific interaction that fall somewhere between apprentissage and dressage. Both are forms of training other animals by shaping their behaviour. However, in apprentissage, the relationship between humans and the animal subjects is of less importance while the behaviour of the animal is shaped. It is also called "scientific training." This is opposed to "circus training," or dressage, where an animal is taught to perform some sort of public act for entertainment purposes. In dressage the relationship of the human trainer and the animals is of great importance, and intense emotional reciprocal involvement usually takes place. With regards to the signing ape projects, dressage seems to be a form of interaction that is most similar to what goes on as the human teachers shape their apes to produce signs.

[262] Umiker-Sebeok and Sebeok (1980) mention one big difference between the relationship of human parents and children, and that of the human teachers and the apes in the language projects. This is that, in contrast to human parents, "the assistants teaching the chimpanzees are brought into contact with the animals for the sole purpose of inculcating in them certain carefully programmed communication skills" (p. 10). This then makes them "more narrowly and intensely focused" on certain aspects of the ape subjects' behaviour than a human parent would be with a child.

Premack's wife Ann mentions what form these expectations sometimes can take (quoted in Umiker-Sebeok & Sebeok, 1980): "People who raise chimps have high expectations for them as they have for their own children, and when the chimps don't perform at these levels, the 'parents' are often bitter."

they were dealing with the first and only apes that were taught human signs to communicate with. The projects were in the line of decades of research into possible ape language, and with using signs rather than speech, it finally seemed to work. The fairy tale of humans communicating directly with the animals appeared to have become a possible reality.[263] Hediger (1980, 1981) refers to it as the intensive, "age-old burning desire of mankind to take up language contact with animals" (p. 2).[264]

Both the different treatment and attitude of the scientists in the signing projects may have led to a forcing of sign behaviour onto the ape subjects with insufficient acknowledgement of the apes' own pace or motivation in acquiring communicative signs. Below the several forms in which this enforcement took place are presented and its possible implications for the nature of the apes' signing behaviour are discussed.

Drill and asking questions.

As has been mentioned before, the asking of what the Gardners have called "known-answer questions" (1989a), such as WHAT THAT?, WHAT YOUR NAME? and WHAT I DO?, was a regular and frequent method used by the humans in teaching signs to the chimpanzees. Human parents also ask questions of their children as a way to teach language. One gets the impression, though, especially with the importance attached to the Wh-questions in the obligatory contexts method, that this was done in a more frequent manner than normal in human parent-child interactions. The Gardners, however, claim in general that they did nothing different from what human parents do in their interactions with the chimpanzees. Roger Fouts, on the other hand, stated the following on the subject in 1975a:

[263] Fouts (1997) expresses the wonder and excitement this caused: "For thousands of years humans had fantasized in myth and fable about talking with animals, and now we were realizing that dream. It was tremendously exciting to be a direct partner in this breakthrough conversation" (p. 104).
[264] Linden (1981) points out that according to the Roman historian Flavius Josephus there was a common belief among Jews that humans could speak with animals before "the Fall" and lost this ability when they were driven from the Garden of Eden.

> Of course, when teaching a particular sign to a chimpanzee we do something somewhat different from what human parents do in teaching their children to speak a language. Since this is a study we are able to select specific signs for training rather then waiting for them to appear. It is reasonable to state that up to this point in this particular type of research there is not as much spontaneous acquisition of ASL as might be found in human children when they acquire their respective language. (p. 156-157)

In general, the (to a certain extent dominant) way of having conversations with the chimpanzees by asking them questions that call for only one correct answer in the obligatory contexts, in itself may depress motivationally spontaneous use of signs by the chimpanzees. It may increase their use of signs just to please humans (to get them off their back in a sense), which can then result in getting a focus on completing a routine verbal interaction, rather than having a more natural, open-ended conversation.[265]

The use of obligatory context-questioning was introduced very early on in the Gardners' projects. Besides it happening every day as an integral part of the human-chimpanzee interaction, it was also used in the reassessment procedure 'Sign Of the Day,' or SOD, described in chapter section 2.1.4.1. This procedure made the humans focused on eliciting one particular sign from the chimpanzee during a day.[266] In the Gardners' second

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[265] Sue Savage-Rumbaugh (with Lewin, 1994) described the experiences she had when she was with the signing chimpanzees in Oklahoma. She makes the following relevant remarks concerning the routine of asking questions:

> If I asked them a question, such as "Where shall we go?" or "What shall we do?" they would frequently string together a variety of symbols they knew, particularly ones we had been using recently, in the apparent hope of hitting on one that sounded good to me. .... The apes often seemed not to realize that they were being asked a "true" question, that is, an open-ended one that they could answer in any way they wished.
>
> Of course, they were queried all the time with questions like "What's this?" "Who's that?" "Where's X" but these questions always had a "correct" answer. That is, if asked the name of a person, the chimps were expected to produce the correct name. Questions such as these revealed little about what the chimp itself wanted or thought; they were simply rhetorical questions that required a signed response. (p.43-44)

[266] The SOD procedure may also have led to cueing of the animals, in the form of what has become known as the Clever Hans effect (see footnote 75 in chapter 2.1.). The humans may have had the intention only to set up the context in such a way as to elicit the sign and make sure not to produce the sign themselves. However, it is easy for cueing to have taken place in such a situation. The humans may inadvertently have made the sign at some point without them realizing or remembering this afterwards, or they may have unconsciously cued or

project, with the group of four cross-fostered chimpanzees, the asking of the well-known questions further occurred in vocabulary tests that were done very often. On one day of every week they would test the individual chimpanzee's vocabulary by asking them questions for every sign in their vocabulary. As with the SOD procedure they would provide the appropriate context for a sign if this was necessary. Once a week all the signs were tested in this way, until the chimpanzee's individual vocabulary progressed beyond a 100 signs. After this they would split the vocabulary list in two. When the vocabulary became too large to continue these tests, they would only sample the chimpanzees' vocabulary (1978).

The asking of these questions and getting responses from the chimpanzees was invested with great importance, as it was considered to be the hardest evidence if the chimps answered correctly in these obligatory contexts. So quite different from human parents with their children, the humans in the chimpanzee projects must have transmitted in many a different way, that the chimpanzees had to answer the questions. This can then have led to a special awareness on the chimpanzees' side that responding to the questions was something the humans particularly wanted them to do. All of these question-answer procedures may then have resulted in the chimpanzees learning to use the signs in a non-spontaneous manner, responding to the questions in order to please the humans. Knowing that by obliging in this way, they could make the humans more receptive to their needs and desires.

The Gardners have openly called the asking of questions within the obligatory contexts "drill sessions."[267] They say in 1971 that

> it became necessary to conduct two formal sessions each day in which appropriate contexts were deliberately introduced for those signs that had not

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prompted the chimpanzees by making only a small part of the sign. However, the results of the SOD procedure were then used to confirm the individual signs within the chimpanzees' vocabularies, and to obtain data on the semantic range of particular signs.

[267] Of relevance here is Vicki Kennerud's (1993) distinction between a conversational and a drill setting. She called those human-chimpanzee interactions drill sessions in which the humans asked the chimpanzees up to six questions in order to have them identify a picture or object. If three WHAT THAT? questions failed, then the chimpanzees were asked up to three times CAN YOU SIGN [name of object or picture]? Kennerud's drill sessions were comparable to the training/drill sessions of the O'Sullivan & Yeager (1989) study (see also chapter 2.3.).

> yet been observed. As Washoe's vocabulary increased, these sessions became longer, and came to take on the nature of drill sessions. The amount of discipline that had to be imposed on our subject also increased, and Washoe's performance during these sessions of drill became more and more perfunctory. As might be expected, the quality of Washoe's signs was far better when she set the pace than when we imposed a drill session. (p. 140-141)[268]

In their 1989 chapter, the Gardners and Nichols similarly mention that they learned early in Project Washoe: "that all forms of drill were counterproductive" (p. 82). Nevertheless, such conclusions did not stop them from carrying out such drill sessions, presenting them twice each day.

The Gardners make a rare admission in 1974a that: "Indeed, we may have overdone this aspect of the first project [the systematic program of data collection and testing that included the frequent asking of questions, ER]; the continual testing that Washoe endured may have inhibited the free growth of her two-way-communication" (p. 8).[269] The production of signs by Washoe was more important then, than making sure that she made signs in and of her own accord, coming from an intrinsic motivation to use the signs. In this way the important issue of using signs or language with an intrinsic motivation was to some extent ignored. The focus on getting Washoe to respond in continuous tests may well have instilled an extrinsic motivation instead. One in which Washoe learned that to make signs would in the end be of benefit to herself. The Gardners defend themselves by saying

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[268] They further say that the 85 reliable signs acquired at the point of writing (32 months into the project) were all made appropriately and spontaneously frequently: at least 20 times during a period of 30 consecutive days (only the sign FUNNY was infrequent, made less than 10 times in the 30 days period). Significantly though is the reason they give for this frequent occurrence. It is the case because they introduced the drill sessions. This shows that many data on the chimpanzees' sign use come from these drill sessions.

[269] In the 1974 Nova documentary Beatrice Gardner explicitly describes the difference that existed with a human upbringing:

> Of course there are certain differences from a domestic environment, mainly the practical ones. Washoe had more human companions than the average child does, more caretakers. And perhaps she had almost too much testing, and too much attention and recording of signs

> yet it was imperative to keep records that were as comprehensive as possible about the course of Washoe's acquisition of sign language [probably referring to the continuous reassessment in obligatory contexts, and the fulfillment of the observational criteria for the reliability of the signs, *ER*]. In particular, we needed to obtain developmental data that could be compared with the available data for human children, and we needed to provide evidence for the meaningful use of sign language by our subject under rigourous test conditions. (p. 8)

The Gardners and Fouts, then, found that a too strong or continuous use of drill when teaching signs depressed the chimpanzees' responses and spontaneous acquisition of signs. However, the depressing effect of drill does not have to imply that chimpanzees are therefore intrinsically interested in learning symbolic signs to transmit information they are desiring humans to know about. All it shows is that chimpanzees can only take so much of drill. Taking a more relaxed attitude may still mean that one is actually forcing the chimpanzees to learn signs.

To further illustrate the important and predominant role of asking questions by the humans, it is insightful to look at the official instructions of the Gardners on how to interact and sign with the chimpanzees, published in 1980.[270] These say that the humans should "reply to the C[himpanzee] with signing before responding with an action. For example, when C signs, *Drink*, ask *What kind of drink?* before running to get the C a glass of water" (p. 367). This rule is particularly instructive, because it shows that from the onset of the projects the responding to questions was directly instrumental in getting the human to fulfil what the chimpanzee requested. It also shows that after the initial spontaneous utterance DRINK, the

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that was going on all the time. That was distinctly different from the course of language acquisition in a child.

[270] Recall also Miles' (1976) remark that the human interlocutor "usually asked Wh-questions such as "Who?," "What's this?," and "What do you want?," as a way to ... induce Ally to converse" (p. 594) (see also chapter 2.4.2.). Indeed, her conclusion was that "Ally's solicited responses [by Wh-questions] are not really characteristic of his natural use of signs and should be considered an artifact of the method."

humans had a rule to evoke further non-spontaneous signing. For the Gardners this was not considered a problem, because they considered a response to a question also to be spontaneous, and did not limit this term to utterances that were made by the chimpanzees without any human evocation (see sections 2.3. and 3.4.).

Also in these "Daily routine of the subjects" instructions, we see that in active play, signing is evoked as well: "The C's prefer to be chased but will reverse roles in chase, so be sure to sign about who does what. .... Sign about who, where and how between bouts of tickling." And: "Plan the game [of hide and seek] by signing before a bout of hide" (p. 363). Because of such rules, the asking of questions by the humans resulted in a stop or pause in the game, making the chimpanzee's response by signs instrumental in getting the game to start or continue.

In Project Nim drill also took place as an integral part of the human-chimpanzee interaction. Comparable to the drill sessions in the Gardner projects, Nim was given intensive sign lessons almost every day. This was done in a special classroom in the Psychology building of the Columbia campus. Three to five times a week he was taken to this classroom, which was kept empty so that the humans could focus his attention more easily on sign instruction.[271] This procedure started in September 1974 (when he was only 9 months old) and continued until the end of the project in August 1977.[272]

A special form of drill in the beginning of Project Nim was his teacher Carol Stewart's use of behaviour modification by appropriate rewarding (see its description in Chapter 1). Each sign was learned in three separate parts: reception, or understanding the

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[271] Next to the classroom, however, was a recreation area where Nim was allowed to play during breaks:

> After an hour or two in the classroom, Nim was allowed to run around in the internal corridor or in the small "gym" across from the classroom. In these areas he had a choice of activities: he could run around in the hallway, play in a sandbox in his gym, climb on a branch suspended above the sandbox, or hoist himself up on a chinning bar wedged into the entrance way of his gym. One activity Nim could never get enough of was being pushed around the internal corridor in a stroller. (1979a, p. 53)

Ristau & Robbins (1982) further report a personal communication from Terrace in which he states that the classroom sessions were "fairly brief (30-45 min each)" (p. 170).

sign's meaning; production, making the correct PCM out of context; and expression, using the sign now in the appropriate context.[273]

Routine questions were also asked daily in Project Nim.[274] Nim's production of signs was often an important, and sometimes the only way by which he could acquire a desired object or have a desired action take place. When they were teaching Nim signs, the humans typically withheld a desired object, then moulded his hands in the correct PCM for the sign, and subsequently asked Nim to produce the sign out of his own accord before he would finally obtain the object or the action was engaged in (Sanders, 1985; Terrace, 1979a; Terrace et al., 1980).

Terrace (1982a) interprets this constant demand by humans for Nim to sign in response to their questions as an explanation for the presence of imitation and wild card signs in Nim's signing: "Having no alternative but to sign, Nim replied by imitating some of the teacher's signs and adding a few universally relevant signs such as *more, me, Nim*, and *hug*" (p. 67). Seidenberg & Petitto (1981) interpret the signing of all the apes in the projects in the following way:

> What the apes appear to have learned is ... that signing behavior was very important. The activity of producing signs was highly valued by their teachers. ... They learned that the mere behavior of producing signs could be used to effect certain outcomes, e.g., getting food, social approval, release from work time, and the like. (p. 126)

They add to this that

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[272] Savage-Rumbaugh & Sevcik (1984) present a transcription of a signing session with Nim and his teachers, which shows the humans drilling him into good performance, maintaining his attention and cooperation by physical force. At one point Terrace even hits Nim for not attending to the session.

[273] At the same time, however, during the six months that Stewart applied this method, Terrace let the other teachers use their own, different methods of teaching and communicating with Nim through signs.

[274] Terrace (1979a) mentions that drilling Nim with questions did occur at certain times in the project. He mentions the behaviour of Susan Quinby, another of Nim's teachers, in this respect. She would repeatedly ask Nim the same question, such as WHO ME before she moved on to another activity. When she brought her cat to Nim, she repeatedly asked Nim WHO THAT? or WHO HUG? before she would allow him to hug the cat. Terrace felt that Nim "became quite bored by this activity and responded to Susan's questions *more because of*

> being able to respond in these ways [the strategies mentioned above] is not an uninteresting skill to have learned. In a very limited sense, it concerns the pragmatics of language use, that is, the relation between an utterance, the context in which it occurs, and the effects it has on the perceiver. This is a form of communication, but not one that relies upon shared linguistic knowledge. (p. 127)

In all the projects then there was a focus on using many routine question-answer patterns every day. This may well have led to the chimpanzees learning to associate certain responses with particular questions in a rote, routine way. Remember that this conclusion had also been drawn at the discussion of the Wh-question tests in the previous section on corpora. Besides frequent questioning, drill and human prompting were an integral part of all project. All of this together may have fostered an extrinsic rather than an intrinsic motivation in the chimpanzees.

Fouts' study on teaching methods.

In this discussion on the spontaneity of the chimpanzees' signing and the role of human prompting, Fouts' 1972 study is important in several respects. Its main findings were that moulding was a successful technique to teach Washoe new signs, whereas imitation hardly did the job at all.[275] Fouts explains this major difference between the two methods by reference to the element of force and coercion upon the chimpanzee subject in the moulding technique. Its success is explained as that it "may force information on the subject, because ...

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her persistence than because of an interest in having a spontaneous conversation with her [italics added]" (p. 119). Terrace then discouraged such repetitive questioning.

[275] This study was carried out when Washoe was at the age of three years. A follow up study was done six years later with the now nine-year-old Washoe and with Lucy, who was then eight years old. This time it was found that there was no difference between moulding or imitation. Both were equally effective in learning new signs (Fouts, Couch & O'Neil, 1979; Fouts, Fouts & Van Cantfort, 1989).

the proprioceptive feedback may be received by the subject regardless of the subject's motivation or attentiveness" (p. 521).[276]

The study also gives a further insight into the procedures used in the projects. At the beginning of each training session in the study, Washoe was given a piece of candy "to attract her attention, and to attempt to prevent her from avoiding him [the experimenter, *ER*] during a training session" (p. 517). If she made the correct sign for an object during the training session, she was given another piece of candy. Indeed, "the candy was within Washoe's view or shown to her throughout the training session in order to keep her attention on the general task and to increase her cooperation with the experimenter" (p. 517). Later in the training, when Washoe made correct responses without prompts, several correct productions were required before she was given a further candy. Other forms of manipulation of Washoe's behaviour were also applied to keep her participating in this experiment: "If Washoe ignored the experimenter or tried to divert him from the task by engaging in mischievous behavior, or by hiding from him during the training session, he would yell at Washoe or threaten her in order to have her return and cooperate in the training session" (p. 517).[277]

The publication includes information on the number of human questions and prompts sometimes present in the training and teaching. Prompts existed in three kinds: moulding Washoe's hands; the human modeling the sign; and the human touching or pointing to the appropriate part of Washoe's body where the sign should be made or even making half of the sign on her body. In the article it is mentioned that the mean of human prompts to have Washoe make her sign sometimes went up to 316 and 319 per hour of training session. The training sessions were carried out twice a day, on three days of the week. Also presented is the number of Washoe's incorrect responses. These number up to 85 and 87 per hour. This

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[276] Fouts, Couch, and O'Neil (1979) say that moulding forces "the subject into a passive response" (p. 298). The Gardners (1971) were initially disinclined to use the technique, as it restricted opportunities for active trial and error.

[277] Further interesting relational behaviour between the humans and the apes is a particular form of effective punishment or discipline that is mentioned by both the Gardners and Terrace. It is the use of social separation or isolation, leaving the chimpanzee all by his- or herself. Nim's early teacher, Carol Stewart, even tried out what

means that Washoe must have had an even larger number of human identification questions (WHAT THAT?) presented within only one hour.

Fouts claims that drilling of this kind only occurred in the study that was just described: "The only other daily activity that might be misconceived of as drilling was the collection of reliability data" (1983a, p. 69). He admits that many questions were asked during the reliability data collection, but he specifies that this was usually interspersed with other activities. That is, the name of an object was asked while there was an ongoing activity with that object. Or they would ask her to label pictures in the form of a game of picture-naming.

Though the training sessions of Fouts' study may only be comparable to a limited extent to the general daily sign sessions within the project, it does give an idea of what the interaction could sometimes amount to. In the form of a game or in a more drill-like fashion, the chimpanzees were subjected to many WHAT THAT? and similar such questions a day, received enticements to cooperate and were sometimes yelled at and threatened if they did not. This treatment will have reinforced an extrinsic motivation to produce signs. Notice that this form of relationship was a practice right from the start of the sign projects. From the beginning of their sign learning the chimpanzees were forced the signs upon them. Making signs was something that the humans invested with a great deal of importance and was of direct consequence for how the chimpanzee was treated by the humans. Signing was of considerable influence to get what the chimpanzee wanted, and to avoid being unpleasantly treated by the humans.[278]

Fouts (1972) also found that a mixed method of teaching was more successful than one particular method alone. This conclusion has been related by the Gardners (1978) to "the

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was called a "time-out box." It was "Carol's position that every time Nim bit someone or screamed too loudly he should be placed in a small, dark enclosure for a fixed period of time" (1979a, p. 58).

[278] The sign transfer study with Ally (Fouts, Chown & Goodin, 1976) has a very relevant paragraph in this regard: "Perhaps as a result of the frustration caused by continually being requested to respond in sign to objects for which he did not have an appropriate sign, early in the experiment the subject began to use the sign *string* (usually signed in an exaggeratedly vigorous manner), and to a lesser extent the sign *feces*, in response to the

sensitivity of a good teacher to the responses of the subjects" (p. 47), that is, listening to the apes when which method is the best to use. The Gardners and Fouts have called their work with the chimpanzees *subject-paced* (Fouts, 1987; Fouts & Fouts, 1993; Fouts & Mellgren, 1976; Gardner & Gardner, 1971; Gardner, Gardner & Nichols, 1989; O'Sullivan, Fouts, Hannum & Schneider, 1982).[279] This implies that the teaching of signs was subject-paced and the participation of the chimpanzees was intrinsically motivated. However, the subject-paced nature of the teaching and testing only pertains to a monitoring of their enduring cooperation and ongoing responsiveness, and to noticing that they will stop responding if you push them too far. That is, however, not equivalent with listening to the chimpanzees themselves as to their own interest in learning and using the signs and participating of their own desire in the several experiments and tests. It is clear that the cross-fosterlings had no choice: they had to learn signs, whether they liked this or not. From their point of view the situation they found themselves in may have been something like this: You are in the power of these experimenters who want you to make certain behaviours that you may not fully grasp or understand. However, you are willing to let yourself be plied in that sense, as long as the drilling is not too complete and enduring, and as long as the rewards used do not divert your attention too much from the behaviours the humans want you to show.

Fouts' study on teaching signs to Booee, Bruno, Cindy and Thelma also contains elements of manipulation and force (Fouts, 1973; Fouts & Couch, 1976). Here, training sessions of 30 minutes took place as often as three times a day, for five days a week. Raisins

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objects. Quite often the vigorous signing of *string* immediately preceded an attempt by the subject to run away from the test situation" (p. 473).

[279] Fouts (1987) defines the Gardners' subject-paced testing as that it "meant the subject was not being forced to respond, or was under duress during the testing" (p. 64). Fouts and Mellgren (1976) describe the subject-paced or subject-oriented nature of the research when they explain that the chimpanzees' cooperation was obtained by setting up the initial part of studies as a new game:

> The unusual aspect of this approach is that it is subject-oriented rather than experimenter-oriented. The objective is to make the task as palatable to the chimpanzee as possible. We have found that the most successful way to do this is to turn the task into a game that the chimpanzees appear to enjoy doing, since they will often initiate the game themselves. Thus, rather than a highly regimented training procedure that serves to force an organism into its paradigm, we have a training procedure that involves more spontaneity and does not force the organism to respond. We try to make it a subject-paced experiment as opposed to an experimenter-paced task. (p. 331)

were given to the chimpanzee after each moulding or when the chimpanzee subject produced the sign without any help from the human. It is mentioned that "if raisins were not effective," other food was given. In this study then, the use of rewards was of central and great importance for the chimpanzees' acquisition of signs. Revealing remarks are that: "Booee during acquisition can best be described as a chimpanzee who was willing to sell his soul for a raisin. This is probably why he did so well in acquisition" (1973, p. 979). And: "he figured out how to sign at frenzied speed just so he could get his raisins. His signing was sloppy and often degenerated, like Washoe's at dinnertime, into a frenzy of begging: FEED BOOEE, FEED BOOEE, FEED BOOEE" (Fouts, 1997, p. 143-144). The female Cindy "was almost too willing to please" (1973, p. 979).[280] Also presented is the downside of manipulation: receiving threats when they did not cooperate. Bruno in particular was not cooperative. Changing his rewards from raisins to apple slices to banana slices and even soft drinks (coke), had no effect. Eventually, Fouts threatened Bruno by triggering the cattle prod, which started buzzing loudly. In response, Bruno immediately started making the sign to be learned (Fouts, 1973, 1997).[281]

Another relevant procedure in the Gardners' projects was the following. If the chimpanzees made the wrong sign within a certain context, or made an incorrect configuration of a sign, the humans would correct the chimpanzees by moulding the sign using the chimpanzees' hands, or by modeling the sign (1989). Though this is a normal learning device, again, such corrections may have depressed the spontaneity of the chimpanzees' signing.[282]

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[280] Significant is the following further remark in Fouts, Couch & O'Neil (1979) about Cindy's behaviour during the double-blind sign test: "Cindy, who needed large amounts of love and reassurance, understandably fell to 26 percent correct responses during the testing situation in which no such love and affection could be administered" (p. 299).

[281] A last remark in this article that is of relevance here is that after the chimpanzees had acquired their first sign, in subsequent training sessions earlier acquired signs were reviewed. Thus, each session did not wholly focus on just learning a new sign. This was considered useful in part "to reduce the possible stress of a training session in which the chimpanzee failed to acquire a new sign" (p. 978).

The use of rewards.

As was just mentioned above, rewards were sometimes an integral part of the teaching and test sessions in the projects with signing chimpanzees. Indeed, this was the case right from the start of the first project. The Gardners applied rewards in order to have Washoe produce signs. They found that tickling her was a very effective way of rewarding her (see further descriptions of the use of rewards in the parts of Chapter 1 that explain the teaching methods). Rewards were thus used to keep the chimpanzee subjects interested in participating in sign interactions with the humans. In all projects, though, rewards were not given every time a chimpanzee signed something (correctly). The Gardners found that giving rewards would sometimes be counterproductive when they administered the object sign tests (see later in this chapter). Besides giving the chimpanzees concrete rewards such as (edible) objects or some favourite action or game, the humans also rewarded the chimpanzees in a more subtle way, by giving the chimpanzees attention, praise and other social reinforcers (see the remarks by Terrace on this subject in chapter 2.4.3.). Rewarding thus played an important role in manipulating the chimpanzees to produce signs. Though rewards were not ever-present, their use may also have added to a less intrinsic motivation in the production of signs.

Motivationally spontaneous sign use.

In this chapter it has been shown up to now that several procedures may have forced the signs upon the chimpanzees and instilled an extrinsic motivation in them. This problem gets exacerbated by an absence of sufficient information on motivationally spontaneous signing by the chimpanzees. The Gardners and Fouts claimed that the signing of their chimpanzees was generally spontaneous. Remember that the spontaneous production of a sign was a requirement for the criterial observations for an observed and reliable sign and was a condition in other procedures. This use of the word "spontaneous" suggests that the

[282] Gardner et al. (1989) mention that they had to use such forms of correction sparingly, as the correction itself would produce an interruption of the normal interaction and could interfere with the ongoing activities.

chimpanzees made the sign out of their own desire or intention. That is, the word is usually interpreted in this way (Ristau & Robbins, 1982). However, as was described in chapter 2.3. on discourse, the Gardners only used the term in relation to the possibly imitated nature of the produced signs. As long as the signs within an utterance were not made immediately before by the human, an utterance was considered spontaneous, even if it followed a human question, such as WHAT THAT? Other forms of human prompting such as pointing to an object also did not make the chimpanzees' signed reaction unspontaneous. Because of this particular definition even the answers given to the questions prominent in the (motivationally) unspontaneous drill sessions, ended up getting classified as spontaneous occurrences. The Gardners' definition of spontaneous is thus a rather broad one. It does not mean that the chimpanzees made the sign out of their own volition. Because the Gardners were satisfied by this definition, they did not analyze what percentage of sign production was spontaneous in a motivational sense and what percentage was elicited by human prompting. No data were published in which a distinction was made between signing that was in response to human prompting and signing by the chimpanzees' own initiative, without any human intervention.

There are several problems with this situation. One is the mentioned lack of information with regards to the intentionally or motivationally spontaneous use of the chimpanzees' signs. Except for a few examples where it is explicitly stated that the chimpanzee utterance did not follow any form of human prompting, the data published by the Gardners and Fouts may have concerned sign production in reaction to the mentioned forms of human prompting and eliciting. Even the reliable signs within their vocabulary may all have entered the sign lists because of the more or less continuous and repetitive forms of questioning by the humans.[283] This lack of clarity then leaves us with a very limited amount of information on the possible communicative intentions in the early years.[284]

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[283] The drill nature of part of the interaction between the humans and chimpanzees in the projects may also have caused the production of certain unstructured sequences of signs which in retrospect where interpreted to

Terrace (1981) and his colleagues (1979, 1980) have drawn explicit attention to the problem of not specifying between prompted and intentionally spontaneous utterances. They do this when they criticize another of Washoe's famous combinations: BABY IN MY DRINK. The Gardners considered this to be a spontaneous description of a doll in Washoe's drinking cup. Because this particular instance starred in the two public films available on Washoe,[285] Terrace and colleagues could perform a discourse analysis of this event. They determined the role of the human interlocutor in this incident, Susan Nichols. The result of this analysis showed that in the immediately preceding scene, Susan had been drilling Washoe extensively to produce BABY IN SHOE and APPLE IN HAT, while Washoe was trying to grab these objects from her. The sequence BABY IN MY DRINK was then produced as a result of Susan first pointing to the doll (to which Washoe signed BABY...), and then to the cup (so Washoe signed ...IN...). Only the signs MY DRINK did not follow an immediate point from the human. This example demonstrates the importance of specifying

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show semantic relations. For example, when Moja signed the following combinations, these were all interpreted to be examples of the Agent+action relation: SUSAN HUG, SUSAN BRUSH, NAOMI HUG, ME DRINK en YOU GO. However, one has to keep in mind that such utterances may well have occurred in routine question-answer interactions, where the chimpanzees learned that it was important to make a name sign if their requests were not fulfilled immediately. Moja may have signed HUG or BRUSH first, Susan may then have asked WHO? or even WHO ME?, pointing to herself, and the resulting combinations SUSAN HUG and SUSAN BRUSH would then be considered spontaneous according to the Gardners' definition.

[284] Also connected to human eliciting of signs is the phenomenon of chimpanzees "titling" the pictures that they draw. This is presented by Roger Fouts (1997) as if they gave titles to their drawings out of their own desire. However, there is no certainty that the signs interpreted as titles did not follow a human Wh-question. Humans often asked the chimpanzees questions such as WHAT THAT? when they finished making a drawing on a piece of paper or other materials. Maybe the chimpanzees thus learned to produce a sign in order to please the humans and answer their repetitive questioning about the chimpanzees' "art work." This may have developed into the chimpanzees using a sort of default signs, such as BIRD, whenever the humans ask them WHAT THAT? of a newly drawn picture or drawing. Systematic analysis of the chimpanzee answers to these human questions could shed more light on this issue. Fouts, however, considers these responses to be actual titles given by the chimpanzees out of their own volition. He says that Moja paints representationally and further states that "it is very possible that other chimps before Moja painted representationally, but it could never be proven because they didn't use signs to title their work" (p. 280). This situation may show that the frequent use of human questioning can lead to drastically altered perceptions and unwarranted conclusions of what chimpanzees do with signs. Rather than patiently awaiting what chimpanzees sign in and of themselves when they have made a drawing, the humans may have immediately asked questions about the drawings. As was shown in the Terrace discourse analysis the humans might then later not be aware that the resulting chimpanzee signing was in response to the questions they had just posed. Thus the humans could come to the conclusion that chimpanzees title their drawings spontaneously.

[285] The *Nova* television documentary *The first signs of Washoe*, and the film produced by the Gardners, *Teaching sign language to the chimpanzee: Washoe.*

the spontaneous or prompted nature of each utterance and cautions against using utterances for which such information is not available.[286]

The Terrace team did provide information on Nim's motivationally spontaneous production of signs. They did not narrow down the use of the word "spontaneous" to non-imitated signing only. Instead they called Nim's signing spontaneous when it did not follow any human signing. Any preceding human utterance, whether it was a question or a statement, was considered to cause possibly prompted signing. Analyzing Nim's signing the team arrived at a number of 13 percent only that was spontaneous in kind. This was in contrast to human children, who show a larger percentage of such spontaneous utterances. This finding led Terrace (1981) to ask himself whether apes sign "because they are coaxed to do so by the teachers" (p. 106) (see also chapter 2.3.).

Implications for naming in the Gardners' vocabulary tests.

The role of drill and enforcement of signing in the daily human-chimpanzee interaction may also have influenced the chimpanzees' participation in naming sessions, including the more formal procedures such as the object sign vocabulary tests. In these tests it was found that giving food rewards worsened the chimpanzees' test performance. The Gardners concluded that the chimpanzees had an intrinsic motivation to transmit information because of their willing participation in these tests. Others argued that social rewards were still plentiful even though food rewards were absent (see section 2.4.).

A closer examination of the procedures of the vocabulary tests is of relevance to the question whether the chimpanzees were spontaneously interested in naming in these tests. First of all, the chimpanzees usually had to be prompted to sign upon seeing a new slide by

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[286] Terrace (1979a) has a further significant remark on what these films showed:

> At first glance, Washoe's signing did not seem to be limited to the satisfaction of basic needs. .... When asked to, Washoe named various objects - flowers, dolls, dogs, and so on. However, films of Washoe's signing suggest that those instances had to be prompted by her teachers with insistent requests such as *What's that?* or *Sign!* Also, unless Washoe signed, she would not be given the flower or the doll or be allowed to play with the dog she wanted. In some

questions from the human experimenter (Gardner & Gardner, 1984). Indeed, in the description of Washoe's vocabulary tests (Gardner & Gardner, 1971, 1974a) it is presented as standard that the human would always ask Washoe what she saw. The human could also ask "sign again," or "sign more clearly."

The tests' designs themselves strike one as being quite artificial, that is, clashing with the regular way of interacting with the chimpanzees. In the slide test (which was set up after two earlier tests with Washoe) there was a test apparatus with a projector and the chimpanzee and humans had to stay put at particular specified places. Then the chimpanzees were taught to press open a small door or press a button in order to see the next slide. Before the actual tests the chimpanzees received many pretests.[287] It was during these pretests that the chimpanzees were continuously rewarded. At first, Washoe (who received rewards not only during the pretests, but also at the test trials themselves) was rewarded for correct answers only. The rewards interfered with Washoe's performance especially when the reward was too desirable or when Washoe was too hungry. They found that at such times Washoe was just too anxious to get the reward and then produced the utmost minimum of response in order to obtain it. This prompted the Gardners to start using food rewards that were very small, such as half a raisin or a quarter of a peanut, called "more symbolic than nourishing" (Gardner & Gardner, 1984, p. 386).[288] When they found that rewards made Washoe less interested in participation, a different procedure was tried with the other three chimpanzees. This time rewards were given immediately after any prompt and clear replies, regardless of correctness. However, they then found that the rewarding interfered with the test itself, in that the

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instances, it seemed that Washoe *had* to be given little pieces of candy before she would sign about the objects her teachers showed her. (p. 21)

[287] After adaptation sessions, Washoe received 19 pretests in the four months preceding her first slide test. Each pretest consisted of a session of between 20 and 40 minutes, in which 36 to 38 trials (slides) were presented. They then subjected her to another 24 pretests in the three following months, and gave her a second test, right before she left the Gardners. The other three chimpanzees (Moja, Tatu and Dar) also received adaptation sessions followed by pretests. They were given about 40 pretests of about 30 trials in the about five months before their first test. Then another bunch of pretests were given, about 30 in a timespan of another four months, at which point their second test was administered (Gardner & Gardner, 1984).

[288] In 1971, when they first mention the vocabulary tests with Washoe, the Gardners mention nowhere that they used rewards in this test.

chimpanzees would ask for the reward at crucial moments in the test. It then says that the Gardners "abandoned" this procedure as well. However, this should not be interpreted as that there were no more rewards from then on at all, because in 1984 it is mentioned that the other three chimpanzees "rarely received any edibles after the initial stages of pretesting" (p. 386).[289]

The behaviour of the chimpanzees in the Gardners' object sign tests is thus no evidence for an intrinsic motivation in communicating information through signs. Though edible rewards were not given constantly, their occasional presence may have motivated the chimpanzees to continue participating. Also, social rewards such as praise and approval were present throughout the tests, further enticing the chimpanzees to continue playing this particular "naming game."

Robustness of signing: Evidence for intrinsic or extrinsic motivation?

Also relevant in this discussion on drill and human prompting, is the matter of the chimpanzees' continuous production of signs throughout decades of years. Does this demonstrate an intrinsic interest in communicating information through signs, or might this also be a result of the high importance humans invested on the sign production by the chimpanzees? It has a certain overwhelming force to think that some of these chimpanzees have continued to use signs for more than three decades now. However, this fact can only be an argument for an intrinsic motivation to use signs when there is substantial evidence for intrinsically motivated sign behaviour throughout all those years. As has been shown, the only evidence presented is anecdotal in nature. At the same time, a great deal of material exists that shows that the procedures with which the humans taught signs, and later continued to have "conversations" with their chimpanzees, made it useful or worthwhile for the chimpanzees to continue signing for extrinsic reasons. It was the humans who invested such

[289] This surprising remark makes one even more suspicious of the purported intrinsic motivation for participating in these tests. It may have been the case that at the times when the chimpanzees did loose interest

strong importance in having the chimpanzees continue to sign, and the reactions of the humans showed the chimpanzees from the beginning how useful making signs was to get one's requests fulfilled. As long as throughout those 30 something years, the humans kept rewarding them daily for using the signs, it is no real wonder that the chimpanzees continued to sign.[290] To refer to the lasting nature of the sign behaviour, giving it a nicely sounding term of "robustness," does nothing to demonstrate that the sign use is intrinsic in nature and is not done to obtain gains from the interaction with humans.

Conclusion.

Drill and human enforcing of sign production took place to a considerable extent in all projects with signing chimpanzees. Many times during the day the humans asked the chimpanzees questions. This can have resulted in routine question-answer patterns without understanding or an intrinsic motivation to respond, on the chimpanzees' side. The chimpanzees may, however, well have been aware that the humans wanted them to sign and had invested considerable importance on their sign production. The use in the projects of rewards and social reinforcers such as praise may also have contributed to a more extrinsic motivation for signing in the chimpanzees. In addition, the chimpanzees were sometimes yelled at or threatened if they did not sign. The frequent use of drill and human prompting may have depressed an intrinsic motivation for sign use and may well have stimulated extrinsic motivations: signing in order to obtain desired objects or actions, or to please the humans and avoid hassle.

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and social rewards were not enough anymore, they were then given a food reward all the same.

[290] Again, rewarding is meant very broadly here. Not only in the obvious way of giving them a piece of raisin after every sign, but also in the other ways mentioned several times now: praising them when signing, approving of their signed responses, and the intricate, almost covert procedure in a sense, of having the chimpanzees sign about objects and actions before they were given to them.

CHAPTER 3

PROBLEMS OF METHOD AND INTERPRETATION.

4. REMAINING PROBLEMS.

In this last section on methodological problems several separate issues of concern will be presented. As in the previous sections, they pertain to certain problematic parts of the methods and design that may have led to ambiguous results and unwarranted conclusions. The first part deals with individual signs. Discussion will center on the method by which these gained status as a reliable sign, and the issue of natural chimpanzee gestures that may be similar to some of the learned signs. Then, the Gardners' later method of categorization of combinations into the various forms of semantic relations will be critically assessed. Several problems will also be pointed out in the methodology and conclusions of some discourse studies, particularly of those of Kennerud, Bodamer and Jensvold. The section will be closed with several additional criticisms of some conclusions on the particular communicative intentions that the signing apes are supposed to have.[291]

[291] Though these criticisms might have been added to the introductory sections on the different aspects of the ape sign use in Chapter 2, it was decided to present them in a last section of the chapter on problems of method and interpretation. This is because, for reasons of clarity, it was attempted to limit Chapter 2 to a presentation of the findings of the projects on the various aspects of sign use, together with the sometimes differing conclusions and opinions of the project leaders. This would then keep the picture of the debate on ape signing clear. Criticisms that had not been mentioned yet by the protagonists in the debate themselves, would then be kept apart for this last section on methodological criticisms.

Some signs may have become reliable by memorization alone.

A major problem regarding the chimpanzee signs is the fact that teaching of candidate signs for reliability (called target signs) took place on the same days on which these were tested (Gardner, Gardner & Nichols, 1989). In the testing of target signs the chimpanzees were asked to name an object or picture by asking them questions such as WHAT THAT?[292] If the chimpanzee made a correct response, this response counted as one of the criterial observations to fulfill the reliability criterion (see 2.1.1). However, on the same days in which these criterial observations of target signs were collected, these same target signs were taught by the humans. The target sign in question (or part of it) would be modeled by the human, or the human would mould the chimpanzee's hands in the correct configuration, place and movement of the sign. The Gardners say that even "a great deal" of teaching took place on these same days. This means that some criterial observations of the target signs may have come about by memory rather than actual acquisition of these signs. The chimpanzee may have remembered the models and mouldings that he or she received as tutorial instances on that same day and then repeated the taught sign when the humans tested them to produce the target signs. For example, the human might have moulded the chimpanzee's hands to produce the sign BALL five times with a ball present as the referent. Later that day, the human may point to the same ball and ask the chimpanzee to name it. The chimpanzee may then remember the mouldings it received earlier and simply reproduce these in the presence of the same stimulus. Such production from memory, however, is not equivalent to a grasp of the meaning of a sign.

This possible confound of the reliability of signs becomes all the more likely because the teaching of a target sign could take place only seconds before the chimpanzee was tested

[292] As was discussed in section 2.1.4., the bulk of the evidence for sign acquisition came from asking the chimpanzees questions.

to produce the same sign. According to the Gardners' criteria, such a production of a target sign would be considered spontaneous as long as it corresponded to the following rule: "after any prompted utterance of a sign, the chimpanzee had to make at least one more utterance in which there was no example of the criterial sign, before the next use of that sign could be scored as unprompted" (p. 84). The humans had a simple way of making the chimpanzee utter something else in between. They asked the chimpanzee a question about some other, irrelevant object. Because signing can take place as quickly as talking, not even a whole minute may lay between the sign being modeled, moulded or otherwise prompted by the human, and the sign being made "spontaneously" by the chimpanzee. Consider as an example a situation where the human is teaching a chimpanzee the sign APPLE. The human first moulds the hand of the chimpanzee several times into the sign for APPLE, in the presence of an apple. The human then asks the chimpanzee to name another object, for example, a banana, to which the chimpanzee then signs something in response. The human then returns to the apple and asks the chimpanzee WHAT THAT? The chimpanzee may then remember the mouldings it received only three turns earlier in the interaction and produce APPLE from memory. In this way some signs may have become officially reliable, whereas the only thing that may have happened is that the chimpanzee remembered what sign the human had just shown him or her only a minute or so before.[293]

[293] A similar confound may have happened in the Wh-question tests. The humans in these tests sometimes corrected the replies of the chimpanzees. The human was not allowed to then immediately ask the same question again within the same context. This was to prevent that the chimpanzee could simply remember the corrected reply by the human and then give this answer to the same question. However, it is unclear how soon the human was then allowed to ask the same question in the same context again. If they employed a similar technique as with the reliability tests, they might ask a different question in between, have the chimpanzee answer that, and then return to the same question that was corrected earlier. To give an example, say there is a picture of a key, the human asks the question WHAT THAT MAKE FROM?, the chimpanzee signs something wrong, say BIRD. The human corrects the reply by signing METAL. Then, the question does not get repeated immediately, but the human asks WHAT THAT? to which the chimpanzee might maybe sign KEY. Following this, the human could repeat the question WHAT THAT MAKE FROM? and now it would be easy for the chimpanzee to remember that the sign METAL is what the human wants to see, regardless of whether the chimpanzee understood anything at all of the question in itself. Occurrences like these may not have happened in this way at all in the Wh-question tests, but they cannot be ruled out either.

Natural gestures.

A further aspect of the chimpanzees' official sign vocabularies worth noticing is that several signs are actually natural communicative chimpanzee gestures, or very close to these (de Waal, 1982; Goodall, 1968, 1986; Plooij, 1978).[294] This is the case with the following three signs in particular: COME/GIMME, HURRY and OPEN. These signs will now be discussed individually.

COME/GIMME. The sign COME/GIMME is made by the signing chimpanzees with an open hand, palm up, held out in front of the signer, and the arm then extends away from the signer towards the addressee, with the arm, wrist or fingers sometimes beckoning, shaking, or wiggling. This sign is almost identical to the natural beckoning or begging gesture that chimpanzees have been observed to use, both in captivity and in their natural habitat (de Waal, 1982; Gardner & Gardner, 1971, 1989a; Goodall 1986; Fouts, 1975a; Plooij, 1978; Reynolds, 1970). This natural gesture's function or supposed meaning is even similar to the English gloss COME/GIMME. The Gardners mention that Washoe used the begging gesture "in situations in which she wanted aid and in situations in which we were holding some object that she wanted," (1969, pp. 667-668). They say that from very early on Washoe "seemed to make this gesture in situations in which she wanted us to come to her and in situations in which a companion was holding some object that she wanted" (1989a, p. 16). The only aspect of COME/GIMME, then, that is slightly different from the natural gesture is the fact that in making COME/GIMME, the signing chimpanzees sometimes accompany the extension of the open hand with beckoning or wiggling movements of the arm, wrist or fingers.[295] The only addition to their natural beckoning gesture that the signing chimpanzees

[294] Indeed, according to Pinker (1994) Jane Goodall, on a visit to Nim, appears to have remarked "that every one of Nim's so-called signs was familiar to her from her observations of chimps in the wild" (p. 338).

[295] Gardner et al. (1989) explain that the adjective "sometimes" means that the described aspect appeared in somewhere between 10 to 49% of the field records. The arm, wrist or finger movements of COME/GIMME then were only made in less than half of the observations of the sign. More than half of the observed instances of COME/GIMME were therefore completely identical to the natural beckoning gesture.

were thus taught were these wiggling movements.[296] In conclusion, one should consider COME/GIMME to be a modified natural gesture. Not surprisingly COME/GIMME was the first sign that Washoe and Moja acquired. It was the third sign that Dar learned, and the fifth for Tatu.

The Fouts claim that Loulis went through a development from using the natural begging gesture to learning COME/GIMME as a distinct sign quite separate from reaching or the natural gesture. Not only did he extend his arm, but he also closed his hand into a fist and then opened it again. They say that in approximately 25% of the times that he signed COME/GIMME, he made the natural begging gesture with his other hand (Fouts, Fouts & Van Cantfort, 1989; Fouts, Hirsch & Fouts, 1982).

HURRY. The sign HURRY is described as being made in front of the signer, with either a spread hand bent at the wrist (Washoe), an open hand bent at the wrist (Moja), an open or curved hand, palm to side (Tatu), or an open hand sometimes with an extended arm (Dar). The movement involved in the sign is described as shaking (with a specification for Tatu and Moja, who both shake the hand up and down, Moja also shaking it from side to side). A natural chimpanzee gesture that functions to speed up others is made in a very similar way. It consists of the hand or wrist shaking repeatedly (see Figure 3.1.). Van Lawick-Goodall (1973) mentions this "wrist-shaking" behaviour ("the hand is shaken extremely rapidly to and fro," p. 166) taking place in the Gombe chimpanzees in aggressive and other contexts. The Gardners (1971, 1989a) report that their chimpanzees made what they described as an impatient gesture: "When waiting for a treat, cross-fosterlings often shook one open hand vigorously at the wrist in an impatient flourish" (1989a, p. 16). Comparing this natural chimpanzee gesture with the officially taught sign HURRY, there is no real difference that can allow for a distinction between the two. Therefore, more so than COME/GIMME, this sign is wholly a natural communicative gesture.

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[296] In 1971 the Gardners mention that a beckoning movement at the wrist is common in the begging gesture of laboratory chimpanzees. They think that this modification "is readily learned when chimpanzees interact with

Figure 3.1. Loulis signing HURRY or wrist-shaking with his left hand.
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OPEN. The PCM for this sign is as follows. It is usually made with both open hands, whose palms contact and then mostly move away from the object or surface that the hands were placed upon and the chimpanzees apparently want to be opened. Washoe's OPEN sign was slightly different. With her the index edges of the hands contact and then separate while making a rotating movement. The natural behaviour this compares to is the simple touching of an object or surface one wants to be opened, and then pounding or banging on it. The Gardners (1989a) describe how Washoe used to behave in this way before she was taught OPEN: "When Washoe wanted us to open a door in those days, she would often hold up both hands and pound on the door with her palms or her knuckles" (p. 17). The only modification of this natural behaviour is the contacting of the hands or, in Washoe case, of the index edges (and her rotating movement). In conclusion, then, OPEN is maybe the closest to an actual sign, though it is strongly based on natural chimpanzee behaviour when a chimpanzee wants something opened.

The three discussed signs are thus in fact natural communicative gestures within the chimpanzees' untaught behavioural repertoire, or sometimes slight modifications of these

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human beings" (p. 138).

gestures.[297] Critics have drawn attention to this situation (Savage-Rumbaugh, 1986; Seidenberg & Petitto, 1979; Wallman, 1992). The Gardners never tried to hide the similarity. Already in 1971 they admit that "we know that a few of Washoe's gestures could have appeared without any specific training, and we guess that this was so for some others" (p. 137). In their opinion, however, the closeness of these signs to their natural gestural equivalents, is only a confirmation of the success of teaching the chimpanzees a gestural form of language (1989a). They describe how they used to build upon these natural gestures in learning them the modifications and in teaching them the importance of using signs within their interaction with humans (Gardner & Gardner, 1971, 1989a).[298]

It is clear that these three signs are not of the same nature as the other signs that are completely new to the chimpanzees' behaviour. Most of the times they are actual occurrences of natural chimpanzee gestures. It is therefore important to set these signs somewhat apart from the other signs and exclude them from vocabulary counts and other data. Seeing them as

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[297] It may be interesting in this respect to mention that the bonobo Kanzi also spontaneously uses gestures that he was not taught (Savage-Rumbaugh, 1984a; Savage-Rumbaugh, Shanker & Taylor, 1998). Among these are: pointing to objects he desires, points to people he wants to get into action, a "go" gesture in the form of extending his arm in the direction he wants to be taken (claimed to be his invention in Savage-Rumbaugh & Lewin, 1994), "chase" by clapping his hands, and a further undescribed "come" gesture. It is unclear, though, to what extent human and other chimpanzee models have influenced the emergence of these gestures (Sherman and Austin used the same "chase" gesture among themselves). Two other gestures are claimed to be his own inventions. In "open" he makes a twisting motion with the hand, as if twisting off a lid. The other gesture is a "rapid handshaking motion, typically directed toward a particular object" (Savage-Rumbaugh et al, 1998, p. 47), interpreted to mean "do something" or "act upon something." Notice the strong similarity of this gesture with the excited, impatient behaviour of chimpanzees, glossed as HURRY by the Gardners.

Sherman and Austin also commonly pointed with an index finger to objects they desired (Savage-Rumbaugh, 1984a; Savage-Rumbaugh & Sevcik, 1984). Premack and Woodruff (1978) reported the spontaneous emergence of pointing in four chimpanzee subjects (Ristau & Robbins, 1982). The pointing was done with an outstretched arm (bringing it close to COME/GIMME) or leg. Again, it is unclear to what extent the chimpanzees had been exposed to human models of pointing, though one can imagine these occurred. Premack and Woodruff suggest that pointing may be derived from reaching behaviour for food (or other objects). Another chimpanzee, called Joni, cross-fostered by a Mrs. Kohts together with her own son in the 1930s, also used several gestures. The chimpanzee extended a hand forward to request, rejected food by turning face and head aside, and expressed thirstiness by putting a hand to the mouth (Kellogg, 1980). Tomasello studied the use and development of natural gestures by chimpanzees in captivity (1990; Tomasello, Gust, & Frost, 1989). Among these spontaneously occurring gestures one can again find several that appear close to the signs learned in the ape language projects. One of these is "wrist-hit," occurring in a play context. This is similar in PCM to CHASE, the sign chimpanzees make to initiate a playful chasing bout. Pointing was also found, as well as "hand-beg," to obtain food from others.

[298] Only once, in their first publication on Project Washoe (1969), do they claim something somewhat different. Here they say that COME/GIMME was not just a modification of the begging gesture, because Washoe was very often seen to beg with one hand, while signing COME/GIMME with the other. The difference between the two was that COME/GIMME was made with palm down near her head (note that this is different from the PCM they published in 1989, given here on page 270). In their later publications they do not hold up this statement, however.

full-blown signs is inflating the chimpanzees' vocabularies, making these look bigger and more impressive than they in fact are.

The importance of setting these signs apart gets illustrated in the study on chimpanzees signing amongst themselves (Fouts & Fouts, 1989; Wallman, 1992). Here it is said that there were 206 signed conversations by Loulis. However, in 134 of these instances, Loulis signed HURRY to the other chimpanzees. What may have happened in these situations is that Loulis simply made the natural impatience gesture, presumably while wanting something from the other chimpanzees. COME was also part of Loulis' frequent signs in this study. It was the sign used in 13 interactions. GIMME was used in two communications. If we subtract the conversations in which Loulis used HURRY or COME/GIMME from the total of observed sign conversations, the total of 206 decreases to a considerably more humble number of 57 conversations.[299] Of the reported sign conversations 72% can therefore be said to consist of natural gestures only. Thus, in this study there is a decrease of actual sign use by almost three quarters of the reported numbers. This is a good example of how natural gestures can inflate the actual sign use, and demonstrates the importance of setting the three signs in question apart from the rest of the learned signs.[300]

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[299] Other telling data from Project Loulis are that what were considered to be Loulis' first combinations all heavily consisted of the troubled signs mentioned. His first official combinations were HURRY GIMME and PERSON COME (Fouts & Fouts, 1989; Fouts, Hirsch & Fouts, 1982). A sample of Loulis' most frequent two-sign combinations between October 1980 and January 1981 produced the following results: HURRY COME was most frequent, with 26 observations, followed by GIMME THAT (with 7 occurrences), COME HURRY (6) and THAT GIMME (3) (Fouts, Hirsch & Fouts, 1982). Surprisingly, the following is said about the meaning of Loulis' combinations: "At this point in our research it is not known what, if any, linguistic difference there is between *come-hurry* and *hurry-come* or any of the other combinations outlined," (Fouts et al., 1982, p. 186).

[300] Seidenberg and Petitto (1979) argue that if a large proportion of the chimpanzees' signs are in fact (modified or extended) natural gestures within their behavioural repertoire, it is more likely that the other acquired signs "were learned in a rote fashion and signed using non-linguistic strategies" (p. 200).

The Gardners' "interpretation-free" categorization of semantic relations.

The Gardners are very critical of using the method of (rich) interpretation to determine the semantic and syntactic structure of children's early utterances.[301] They point out the difficulty for an investigator (or indeed, a parent) to know what the child's intended meaning of a combination is. They give special attention to the combination "Mommy sock" by the child Kathryn in a study by Lois Bloom (1970). Bloom interpreted the occurrence of this combination on two separate occasions by using context notes. On one occasion Kathryn picked up her mother's sock, so "Mommy sock" was then interpreted to express the possessive relation. The other instance took place when her mother was putting Kathryn's sock on Kathryn, so this was thought to be an instance of the Agent+object relation. The Gardners retort that if Kathryn tried to express two different relations on these two occasions, she apparently failed to do so.[302] They say that "the linguistic ingenuity and intelligence in rich interpretation belong to the investigators rather than the children" (Gardner & Gardner, 1994a, p. 244). In other words, when investigators are interpreting they can project meaningfulness and linguistic prowess into child utterances, when in fact these may be devoid of such meaning or linguistic nature.[303]

The Gardners mainly use this critique to argue against claims of early word order in the combinations of children. These claims are also based on rich interpretation. For example,

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[301] See their 1974b discussion of Brown's major work *A First Language: The Early Stages* (1973).

[302] They point out that Kathryn's mother took the second "Mommy sock" to express the possessive relation as well, saying "That's not mother's sock." They then criticize Bloom for dismissing the mother's interpretation because Bloom claimed that it was unlikely that Kathryn had mistakenly identified the sock's possessor.

[303] Bloom herself, and practically all child language investigators, are well aware of the problems of interpretation, and repeatedly mention throughout their publications the relative status of their judgments, and the need to avoid overinterpretation (Bloom, 1970; Bloom, Lightbown & Hood, 1975; Bowerman, 1973a; Brown, 1973). For example, Bloom (1970) explains the status of her semantic interpretations as follows:

> This is not to say that the inherent 'meaning' or the child's actual semantic intent was obtainable for any given utterance. The semantic interpretation inherent in an utterance is part of the intuition of the child and cannot be 'known' with authority. The only claim that could be made was that evaluation of an utterance in relation to the context in which it occurred provided more information for analyzing intrinsic structure than would a simple distributional analysis of the recorded corpus. (p. 10)

the famous linguist Roger Brown interpreted both "Adam sit chair" and "Sit Adam chair" to be of a correct word order, by interpreting the second phrase as an Action+object relation, where "Adam chair" is thought to mean the possessive: "Sit Adam['s] chair." The Gardners say that by use of rich interpretation linguists can incorporate any word order used by a child as appropriate. These linguists' claims on the prevalence of word order from early on are therefore totally invalidated. The Gardners (1974b) do not want to make the same mistake with their chimpanzees: "Because we Gardners are strict behaviorists and firmly committed to the law of parsimony, we refused to use the method of rich interpretation as evidence that Washoe did use sign order as a grammatical device" (p. 734). However, in all their publications before 1994, it is clear that they themselves used interpretation when they determined the semantic relations within combinations. And this was a "rich" interpretation in the same way as Roger Brown meant it, that is, with use of as much contextual information as available. In their early publications they were also not as contrary to the use of interpretation as in their later writings on this subject. In their 1971 article they say that the method of interpretation by using contextual information "has obvious pitfalls, but it does permit an investigator to make certain weak inferences" (p. 173). They then say that because so much work on early child language is based upon the use of this method, they consider it appropriate to use it to analyze Washoe's early combinations.

It is only in 1994a that they mention that they no longer use interpretation to determine semantic relations. The following, in their eyes less biased method was now used. From the outset, each sign in the chimpanzees' vocabularies was assigned to one of ten different semantic categories (see their description in section 2.1.3.). This was done by looking at the usage of the sign by the chimpanzees. Thus they determined that some signs were always made for objects, such as APPLE and BALL, whereas others were for actions only, such as CHASE and OPEN. Thus, each sign pertained to only one semantic category, so whenever a sign was made it unambiguously belonged to only one of the semantic

categories.[304] The Gardners then grouped two-sign combinations into phrase patterns based on the semantic categories of the respective signs. They ended up with patterns of two combined semantic roles. These can consist of an agent and an action sign, or an object and an action sign, and so on for all possible combinations. For example, GROOM DAR, YOU TICKLE and SUSAN CHASE are all instances in which a person sign is combined with an action sign. All of these phrases are then categorized as expressions of the Agent+action relation. Similarly, combinations such as BLACK HAT and GLASS MIRROR are phrases in which an object sign is combined with an attributive (a colour and a material in these examples). Both combinations would then be examples of the Attributive semantic relation.

The fact that each sign had been pre-assigned by the Gardners into one, and only one, of the ten semantic categories enabled them to make the further analysis of two-sign combinations an interpretation-free process.[305] All that was necessary was to transcribe sign combinations as a combination pattern of two semantic roles. A table of semantic relations (reproduced in section 4.2) then showed which patterns belonged to which relation. This whole process was automatic and did not include any interpretation. In this way the Gardners avoided the pitfalls of subjective interpretation that they considered to be so prevalent in the child language studies.[306] The outcomes of these automatic and unbiased analyses were then used to demonstrate another major similarity of the chimpanzees' "language" development with that of human children: the developmental order of appearance of the semantic relations (see section 2.2.2).

In 1994a then, the Gardners leave it at this, assigning combinations to semantic relations in this interpretation-free way. They do not take into account the context in which

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[304] There was only one category where a sign could belong to more than one semantic category. This was the "noun/verb" category, which, more appropriately, should be called object/action category. It contained signs such as BRUSH and DRINK, that were sometimes used to refer to objects (brushes and drinks) and on other occasions to actions (brushing and drinking).

[305] This procedure has a serious problem in that pre-assigning a sign to only one semantic category leaves little room for the possible use of a sign in multiple semantic categories, or for developments and changes over time (the latter is especially the case if the pre-assignment does not get updated regularly).

the combinations were made, nor do they provide information on the question whether the combinations made sense at all. Though the Gardners may be skeptical of (rich) interpretation, some sort of plausible interpretation must be made in order to assess the combinations of signs. How else would one decide that the combinations were indeed meaningfully structured? The word "semantic" already implies that there is meaning involved in these relations. One cannot avoid all interpretation while at the same time claim that the chimpanzees express meaningful, semantic relations when they combine signs. If no interpretation of meaning is applied, than there is no basis to infer semantic relations.

Besides the impossibility of what the Gardners are trying to do here, the new method also does not detect combinations of signs that are clearly without meaning or structure. Sequences without a meaningful relation between the two signs, but in which the chimpanzees appear to be saying two separate things in the same utterance, cannot be found. Because all combinations are assigned to relations based on the semantic categories of the individual signs and no further assessment is made of their meaningfulness or sensemaking, one cannot sift out the clearly meaningless ones. To give a hypothetical example, in the Gardners' analysis GUM CHASE would automatically be assigned to the Object+action semantic relation. However, it is hard to imagine that this combination expresses an action that is done with an object (chasing gum). Furthermore, if one knows that the chimpanzees frequently ask for gum and chase games in 1-sign utterances, then it can be inappropriate to consider this combination to show a semantic relation at all. The Gardners ignored this logic that critics have put forward, and simply assigned the combinations in the decontextualized way described. There is therefore no way of knowing how many combinations in their calculations were meaningless, coincidental pairings of two signs and how big a percentage made sense and may have shown semantic relations. The claims the Gardners make based on their automatic method are therefore unsubstantiated.

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[306] Indeed they thought to be really objective in using this method, proudly mentioning that they could even use their wordprocessor to do this job, having it automatically assign combinations to phrase patterns on the basis of

Kennerud; O'Sullivan and Yeager.

The results of the Kennerud study (described in chapter 2.3.) showed that the chimpanzees produced more spontaneous utterances in the conversation setting than in the drill setting. However, unexpectedly, the chimpanzees produced more imitated utterances in the conversation setting as well. In the discussion, Kennerud attempts to account for this latter finding, in part, by suggesting that "staying 'on topic' in conversation may make repetition of relevant signs more likely" (p. 48).

However, alternative explanations can account for the results of Kennerud's study. First, the higher percentage of spontaneous utterances in the conversation setting is an artifact of the study. Kennerud had used O'Sullivan and Yeager's 1989 definition of a spontaneous utterance, which considered a chimpanzee's utterance to be spontaneous if the human had not signed within the five seconds preceding the chimpanzee's sign. This criterion is appropriate, but when it is applied without taking the implications of the particular design into account, the results may suffer from a methodological flaw. Thus, in the drill sessions the human repeatedly asked the chimpanzee questions such as WHAT THAT? and CAN YOU SIGN X? and continued to ask the chimpanzee to make a sign for the presented pictures and objects throughout the session. The design of the drill sessions therefore strongly reduced the possibility of the chimpanzee making a spontaneous utterance, that is, an utterance that was not preceded by a human utterance in the five seconds before. This artificially increased the number of adjacent utterances (utterances made within five seconds after the end of a human utterance) in the drill sessions.[307] In contrast, in the conversation sessions the human was not constantly asking the chimpanzee to identify things, and more relaxed interaction,

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the unambiguous semantic categories only (1994a).

interspersed with play and grooming, took place. The conversation setting therefore allowed for greater percentages of spontaneous utterances by the chimpanzees.[308]

The same problem is actually present in O'Sullivan and Yeager's (1989) study with Nim Chimpsky, on which Kennerud's studies are based. The results of that study were that Nim only had 14% spontaneous utterances in the drill/training sample, compared to 60% in the conversation sessions. Again, this result is caused by the human frequently asking the chimpanzee to identify and sign about things, thus leaving little opportunity for the chimpanzee to make utterances that are not preceded by human utterances.

O'Sullivan and Yeager also stress that Nim made twice as many imitations in the drill session than in the conversation sessions. However, this comparison is also skewed because the drill session contained more opportunity for imitation as most of Nim's utterances were bound to be adjacent. A better comparison might be to compare the imitated utterances as a percentage of only the adjacent utterances in both contexts. Calculated in this way, Nim's imitated utterances consisted of 25% of his total adjacent utterances in the drill context, compared to 20% in the conversation context, leaving only a fifth more imitated utterances in the drill setting than in the conversation one. O'Sullivan and Yeager actually criticize Terrace for calculating the percentage of imitation as part of the adjacent utterances only, as this would inflate the rate of imitation and produce higher percentages. However, in their study it was more appropriate to calculate the percentage of imitation of adjacent utterances, because the differences in setting would otherwise have caused a deflation of the imitation percentage.

Returning to the results of Kennerud's study, another important though unexpected finding is that the percentage of imitated utterances is actually higher in the conversation

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[307] Bloom, Rocissano and Hood (1976) report the same phenomenon in their study on child imitation. When there were many utterances from the adult, there were few opportunities for nonadjacent speech by the children.

[308] This setting difference at the same time accounts for the greater percentage of adjacent/novel utterances in the drill session than in the conversation session. Because there was little opportunity for chimpanzee utterances that were not preceded in the five previous seconds by a human utterance, nonimitated utterances would generally fall into the adjacent/novel category.

sessions than in the drill sessions. Only Loulis has a higher number of imitations in drills than in conversations (38.03 versus 5.81%). Kennerud says that this can be explained by Loulis' limited sign use in this study (only five signs), of which THAT is a prominent one. Loulis' use of THAT results in an imitation coding if it follows the human question WHAT THAT (which often occurred in the drill sessions). The design of the two conditions also causes the difference in imitation for the other chimpanzees. In the drill condition the majority of the human's utterances consist of WHAT THAT? questions. The chimpanzees do not have the sign WHAT in their vocabulary, so they cannot imitate it.[309] They may also understand that they should produce another sign than THAT when the human asks them to name things, so that does not leave them with THAT to sign. The lesser percentage of imitation for the other chimpanzees in the drill session can therefore be explained by the particular setting of humans asking WHAT THAT? most of the time.

Bodamer.

Bodamer's conclusions of his dissertation study were that the chimpanzees used their signs conversationally, and that they were attentive and responsive to the human interlocutor. Indeed, the chimpanzees were thought to have achieved the status of conversational partners. This representation adds to the linguistic interpretation of the chimpanzees' sign use. The following criticisms, however, speak against such a linguistic interpretation. Indeed, the sign use of the chimpanzees in the different conditions actually confirms a non-linguistic interpretation in which the signs serve to obtain things from the humans.

First of all, and this criticism is also applicable to the Jensvold study (which is an extension of Bodamer's), the different amounts of imitation in the four different conditions may be wrongly interpreted. Much is made of the fact that the chimpanzees do not imitate after the WHAT probes. This is interpreted to demonstrate that the chimpanzees understand

[309] WHAT was only reliably acquired by Moja, but there are no published reports of observations of Moja using the sign after the early years with the Gardners.

that they should give new information after such a question, and that imitating the sign would not succeed in maintaining the good course of the conversation. However, as was mentioned above, the sign WHAT is not part of the chimpanzees' vocabularies, so it is not surprising that this sign is not imitated. The same applies to the signs CAN'T, YES (made by the humans in the Bodamer and Jensvold studies by shaking a closed fist upside down with palm down), and NO (which in both the Bodamer and the Jensvold study is usually made by bringing the index and middle finger together on the thumb). Use of the sign CAN'T has not been published after the early years with the Gardners. The sign YES has only been present in Moja's official vocabulary. However, it is made quite differently from the human YES in the Bodamer and Jensvold studies, in that in Moja's form of YES she only shakes her head up and down. The same situation is the case with NO. The chimpanzees sign NO by shaking their head sideways, which is an altogether different form than the human NO used by Bodamer and Jensvold.

So the fact that there is less or no imitation when the human signs WHAT, YES, NO or CAN'T to the chimpanzees, can be explained by the absence of these signs within the chimpanzees' vocabularies or their sparse use of these. There is therefore no need to infer that their behaviour in those conditions shows a grasp of conversational rules. This explanation, however, is overlooked by both Bodamer and Jensvold. In their calculations, the chimpanzees' responses were quantitatively analyzed. Any response by the chimpanzees that did not involve a sign just made by the humans counted as nonimitative. No attention was paid to the presence of the human signs within the chimpanzees' vocabularies. Though both humans and chimpanzees may make attempts at imitating signs that they do not yet know, it may be more appropriate to look at imitation of signs that are already part of their vocabulary. An analysis of imitation would be considerably troubled if researchers looked at imitation of words such as *university* or *serendipity* in two-year-old children. A focus on

imitation of words such as *gimme* and *food* would be a more appropriate way to analyze the nature of this phenomenon in these children.[310]

In Bodamer's On Topic condition, the questions usually evoked responses from the chimpanzees that included some of the signs from these questions. This was then interpreted to show (as Kennerud did in her study) that the chimpanzees were trying to "stay on topic," meaning that the chimpanzees wanted to continue communicating about the same subject that the humans signed about. However, it is especially in the On Topic condition that the chimpanzees are able to imitate the human, because the human actually uses signs that are in their vocabulary. In other words, rather than staying on topic, the chimpanzees may always use imitation in a non-linguistic way, but this particularly reveals itself in the On Topic condition. It is especially in this condition that their use of imitation can be detected.

Bodamer also considered it conversationally appropriate that the chimpanzees usually changed the content of their utterance after the first WHAT probe in all the conditions. However, this may be a consequence of the fact that the chimpanzee notices that his or her initial request is not immediately gratified by the human, so the chimpanzee will have to try something else subsequently.

An ominous finding in the Bodamer study is that there was actually no difference in response by the chimpanzees between the Affirmative and Denial condition. In both conditions the chimpanzees "tended to reiterate signs from their previous turn as if keeping the interaction on a specific subject regardless of encouragement or discouragement in the signs of their human interlocutor" (p. 53). This fact actually disconfirms the interpretation of the chimpanzees' behaviour as conversationally appropriate. Indeed, it confirms an interpretation in which the chimpanzees only use signs acquisitively, regardless of actual conversational rules. They will go on to make more signs until the human finally gets into

[310] Several studies are relevant here. Nelson (1973) found that children imitate much more frequently a word they already know, than a word that was not in their vocabulary. Bloom et al. (1974, 1976) found that children did not imitate entirely novel material nor what they knew best, but lexical and structural features that they were

action and gives them what they want. Moreover, the YES condition is in its immediate consequences no different from the NO condition. The human saying YES does not result in subsequent immediate action by the human to go and execute the chimpanzee's desire. For the chimpanzee all that happens is the human making a signed utterance yet staying put on his chair and looking at the chimpanzee to see what the chimpanzee will do next. Thus, the absence of a difference between the two conditions can be interpreted to show that the chimpanzees mainly monitor whether their signing has an effect on the actions of the human and that they are not specifically interested in the (contents of the) sign response of the human. They are interested in the human actions, not in their particular sign utterances. Their strategy appears to be: if the human does not get into action, continue signing more. This then also explains why they make senseless strings of signs.

Finally, another interesting finding, though it is unclear how to assess this, is that the chimpanzees, contrary to Bodamer's expectation, sometimes actually signed to his back. Obviously the chimpanzees used the attention-getters DIRTY and PERSON to make Bodamer turn towards the chimpanzees and attend to their wants. Indeed, an impression of the frequency with which these two signs are used as attention-getters is given here (which adds fuel to the author's remarks on the use of DIRTY in the remote videotape studies on chimp-to-chimp and private signing, see section 3.2.). Table 6 of Bodamer's dissertation shows that in 115 trials or sessions one or more signs were made at the beginning of the session when the human still had his back towards the chimpanzees. These signs always were accompanied with attention-getting sounds such as bronx cheers, handclaps or lipsmacking. In 25% of the total of 459 sessions, these initiations were started by the chimpanzee using a sign before Bodamer had turned towards them. In Table 7 Bodamer then makes a distinction between what he calls "noisy" and "quiet" signs. The frequency with which each was used is then presented. The majority of the signs made while Bodamer had his back to the

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learning and were starting to acquire. Fouts' 1972 study on teaching methods also demonstrated that Washoe rarely succeeded in imitating signs involving new motor patterns.

chimpanzees were noisy (72 of the 115 sessions). The majority of these noisy sign initiations were made by Washoe. She used noisy signs to attract Bodamer's attention in 55 of those 72 sessions. This is of interest for Washoe's frequent use of DIRTY in the remote video tape studies on private signing, giving further probability of her using this sign not as an expression of emotion in those studies, but as an attention-getter towards the absent humans. In conclusion, in most of the trials (72) in which a sign was produced while the human still had his back towards the chimpanzees, attention-getting signs were used. However, in the remaining 43 sessions quiet signs were used that did not have an apparent attention-getting function.

Jensvold.

Jensvold's conclusion on the chimpanzees' signing in her dissertation study was that this was conversationally appropriate and contingent on the different conditions, again demonstrating the chimpanzees' grasp of pragmatic, conversational rules. According to her, the chimpanzees' responses were even comparable to those of "older children," and the chimpanzees showed an "ability to adapt to listener feedback" (p. 5).

Similar to the Bodamer study, however, there are problems in the methods and analyses that gave rise to these conclusions. Indeed, on closer examination, the conclusions can also be reversed to imply that the chimpanzees' responses show a lack of grasp that the interaction is indeed a conversation.

As in the Bodamer study, the imitation of signs from the human question in the On Topic condition is presented as "topic maintenance." However, another interpretation is possible. The chimpanzee notices that the human has used a sign from their own initial utterance, and may think that repeating that sign (with maybe the addition of a wild card sign) may be useful to get the human into action.

Another problem with Jensvold's conclusions is that no attention is given to the role of nonverbal cueing as an explanation for the differences between the conditions. Thus, less response in the CAN'T condition, may have been caused by the human's signed utterance being accompanied by negative or uncooperative nonverbal behaviour (in attitude, posture, or manner) that is easily readable for the chimpanzees and that may then cue them as to what they can expect from the human. Nonverbal behaviour may also have played a part in the Disruptive condition. Since Jensvold utters nonsense questions out of context, one can imagine that there are minute changes in her spontaneity or authenticity of response that are noticed by the chimpanzees and that equal a negation of their initial request. This in turn may then cause the depression of chimpanzee responses in this condition.

The absence of imitation and prevalence of expansion in the General condition was interpreted by Jensvold as comparable to what "older" human children do in conversations. However, it may be obvious that there is no imitation in this particular condition. The human's first probe in this condition is not even a sign but just a general questioning expression, so there is no sign to imitate. The second probe, WHAT, suffers from the same problem of not pertaining to the chimpanzees' vocabularies, as mentioned before. Finally, the human's third probe, the composite sign DON'T-UNDERSTAND is a sign which was never taught to the chimpanzees, let alone that they acquired it or know how to make it. The prevalence of expansion of their earlier utterances is also no unexplainable matter, because the chimpanzees can understand nonverbally that, different from the Can't and Disruptive condition, the human is attending to what they signed, so signing more may provoke the human into subsequently giving them what they asked for.

COMMUNICATIVE INTENTIONS

Besides the specific methodological problems that were discussed above, there are also several criticisms possible of the interpretations that the Gardners and Fouts have made with regards to the chimpanzees' communicative intentions when they use signs.

Questions: Requests for information or for commodities?

The first point of discussion regards the claim that Washoe and the other chimpanzees ask questions and make "opening statements," behaviours that would go beyond uttering simple requests. These questions should therefore be interpreted as actual requests for information rather than requests for objects and actions. However, besides the examples mentioned in 2.4.5. no further information is given about these behaviours. Without more knowledge about the actual questions and opening statements with which Washoe herself initiated signed interactions, it cannot be ruled out that she was only signing in an "acquisitive" way, that is making requests to acquire desired objects and actions. Suppose that the questions Washoe generally asked were questions such as FOOD? or WASHOE DRINK? Questions like these would not be equivalent to requests for information. Similarly with her opening statements. If these were utterances such as BANANA THERE, then these too, though they may be demonstrative of Washoe initiating the interaction, may have been nothing else than further requests for objects and actions.[311]

The remarkable thing with the example in which Tatu asks FLOWER about a picture of a flower (page 162), is that she is asking something about an object for which she already

[311] The anecdote about Washoe signing TOOTHBRUSH in the Gardners' bathroom (see page 159 of this dissertation) also does not necessarily need to be interpreted as an utterance that goes beyond making a request. The description the Gardners give of this utterance as Washoe having no other motive than communication, is quite a vague wording. It implies that Washoe was not requesting something by signing TOOTHBRUSH. One might interpret this instance as one where Washoe is naming an object. But how intrinsic can one call this, when her days are spent with being taught to make signs and being asked to produce signs for objects and things the whole time? It is also the first time the Gardners see her making the sign, so maybe all she was doing right then and there was practicing it. And despite its appearance, though the toothbrushes were within her reach, signing TOOTHBRUSH may still have been some sort of asking permission to grab a toothbrush.

knows the sign. Had she been asking THAT? about a picture of a rhinoceros or another unknown thing, than her behaviour would have been more clearly a request for information.

The three published examples by the Gardners are all tied to the naming of pictures, an important part of the routine communication between the chimpanzees and the humans. In the absence of further data there is no way to assess how sensible their questioning in general was. One does not know whether to interpret their questions as simple requests for objects and actions, or as basically another routine human-pleasing activity.[312] The asking of WHAT THAT? to the human may also be a break of the sometimes probably tiring routine of the sessions. Fouts has called this behaviour (regarding Lucy, whose WHAT THAT? questions were one of her favourite games) "turning the tables on the humans." It may thus also be an attempt to be in charge at last in the interaction, commandeering the human rather than having to constantly reply to the frequent human questions.

Additional examples of the chimpanzees asking questions have been given by the Fouts. In one instance, published in Gorcyca, Garner and Fouts (1982) it is quite obvious that the questioning is not done with an intention to request information, but exactly to request more food:

> Once during a signing session between Bruno and Ally the teacher at one time ran out of food. As an experimenter walked to the barn for more food, Bruno stared, turned to the teacher, signed 'more food', looked towards the returning experimenter and repeated the signs. Each time the sign for food was held for a few seconds, the means of indicating a question in Ameslan. (p. 230)

Much has been made of the fact that sometimes the chimpanzees, as Bruno in this example, show behaviour that is similar to asking questions in American Sign Language, interpreting

[312] Terrace et al. (1980) mention that Nim had originally been credited with the acquisition of the sign WHAT. However, after reviewing their data, they concluded that Nim had not actually grasped the meaning of this sign and they withdrew it from his vocabulary. Instead they interpreted the sign as just a routine event marker. Nim's production of WHAT always was in combination with another sign, and in a routine fashion it always took up the first position in the combination. No further details are given about the way in which it was a routine event marker.

this as another similarity with actual ASL and therefore with language in general. However, the behaviour may be accounted for by other explanations than an acquisition of ASL. The chimpanzee may be mesmerized or expecting the desired item, holding the last sign as a form of emphasizing his or her request rather than asking information about something. Awaiting a response from the human by keeping eye contact with the human, is indeed part of the operational definition of the communicative intention of requesting objects and actions (see section 4.2.7. in the Method chapter). Only if the content of the utterance itself can be interpreted within the context as a genuine request for information would the positioning of this communicative intention be justified. The Gardners and Fouts, however, did not make a systematic distinction of the chimpanzee question behaviour between requesting objects or actions, and requesting information.[313] An observation such as the one above about Bruno then becomes part of the total material on the chimpanzees' signing, in the form of "asking questions." Which in its turn is then presented as sign behaviour that goes beyond requesting things.

Chimpanzees signing amongst themselves: With what intentions?

The way in which the signing amongst the chimpanzees themselves has been presented also suggests that this form of sign use is generally intended to communicate something else than just requests.

The studies on the chimpanzee-to-chimpanzee signing (see their presentation in section 2.4.7.) have some relevant data with which to interpret the underlying communicative intentions when they communicate in sign with each other. The great frequency with which HURRY and CHASE were used, in fact shows that, though the chimpanzees may not have wanted food from each other, they did want something from each other. HURRY in itself,

[313] For Loulis it is claimed that he has asked questions as well. Again, this is stated in the same multi-interpretable sense. However, the suggestion is given that Loulis too, was requesting information when he was asking questions. Nevertheless, the examples given by Debbi Fouts (1989), DRINK, THAT HURRY GIMME and HURRY HOSE, show that the "questions" presented can all be interpreted as requests for objects.

even as a natural chimpanzee behaviour, implies that the chimpanzee wants something from the others. Of course, requesting play as in the use of CHASE by Dar and Loulis is just another form of acquisitive sign use in the definition given by Terrace. The use of HUG is a request for action in the form of an invitation to a reassuring embrace in the example given of Dar and Washoe. Moja's use of HUG when she is in heat is not fully clear from the text, but it is obvious that she wants one thing or another from Dar.

The Fouts' conclusion that the chimpanzee-to-chimpanzee signing goes beyond obtaining rewards or food, does not entail that it is any less acquisitive or requesting in nature than their sign use towards humans. The little information that is presented shows that all of the signed utterances among the chimpanzees are requests for actions. The low incidence of food-related sign use between the chimpanzees is not that inexplicable either. The chimpanzees are not the ones who have access to food and who decide when they give another chimpanzee something to eat. It is therefore to be expected that they mainly sign action requests to each other and keep object and food requests more reserved for their human companions.

Debbi Fouts (1989), though, gives quite a different impression of this type of signing behaviour, when she concludes that: "All of these chimpanzee signs were conversational without visible extrinsic rewards" (p. 249). Certainly, the chimpanzees did not reward each other with a raisin or peanut every time they made a sign to each other, but to obtain chase play, body parts for grooming, and reassurance, can be a very rewarding, "self-supporting" use of signs.[314]

Consider also the example presented by Fouts (1997; Fouts et al., 1978), see footnote 158 of this dissertation, where Booee waits for Ally to properly sign, prompting Ally to produce YOU GIVE ME FOOD for some food that Booee is holding. This example suggests

[314] The Fouts later are even starker in their conclusion, even though their published data do not provide the knowledge they claim to have here: "Debbi found that the chimpanzees talked mainly about their social interactions. She also found that when they talked about food it wasn't to obtain food. Instead, they merely

that Booee intrinsically attaches some form of importance to communication in signs with his conspecific, and that he even appears to teach Ally signs. However, only in Gorcyca et al. 1982 is it mentioned that this observation occurred during a study with Booee, Bruno and Ally, in which it was instrumental that all three chimpanzees produced signs. If one of them did not sign, none of them got a food reward from the human companion. This information throws another light on the behaviour of Booee prompting Ally to sign.[315] In 1978 and 1997, however, the observation is published without mentioning that it was part of this constructed experiment, leaving the naive reader in awe, and the sceptic reader in strong disbelief.

Insulting signs.

Similar interpretation problems exist with the Fouts' claim that the chimpanzees will use signs to insult people and other individuals that they dislike. Take the example where Washoe signs DIRTY MONKEY about the macaque in Oklahoma. Because this instance is of an anecdotal nature it is possible that Roger Fouts was the one who first signed DIRTY in reference to the monkey, when Washoe and the monkey were still behaving aggressively and he had not yet asked Washoe what the monkey was. Also, Washoe's subsequent behaviour in this situation is very significant. She responds with DIRTY to Fouts' questions about monkeys with whom she did not have a conflict. This may be explained by Fouts' reaction to Washoe's first DIRTY. He may have been fascinated by her use of DIRTY and may therefore have nonverbally reinforced her to make the particular sign again. The Gardners (1980) made an important remark in this regard when they stated that only the very first observation of an interesting spontaneous use of a sign is of significance: "Because it is impossible to preclude the possibility that human companions may reinforce the subject in

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talked about it just as we might talk about some of our favourite foods without having to hear or even see them" (1993, p. 34).

[315] Indeed, Gorcyca et al. admit that the frequency of signing by the chimpanzees in this study was a "demand result" produced by the setup.

some way for such responses, replication of spontaneous and appropriate usage with the same subject might rest primarily on the effect of her reinforcement" (p. 355).

Another light is thrown on the use of the sign DIRTY altogether, when one considers that it has been reported as a sign that is used by the chimpanzees to draw the attention of a human who is not currently attending to them. DIRTY is one of the few "noisy" signs, which make a sound when you carry them out. It is made by contacting the back of one hand to the underside of the chin. If the contacting is done strong enough it turns into hitting the chin, making one's jaws click together, turning it into a well audible sound.[316] There are other such attention-getting signs that the chimpanzees make. One is a forceful use of the HAT/PERSON sign (made by patting one's head).[317] Another noisy sign in this category is actually another sign that has been interpreted as a sign that refers to internal states such as emotions. This is the sign HUG, usually represented as the sign for HUG/LOVE (as in ASL it can be used to refer to both "hug" and "love"). Making this sign also produces noise. It is done by both hands crossing the forearms and grasping the chest and upper arm. Again, when this is done forcefully, a well audible sound results.[318] The noisy signs DIRTY, PERSON and HUG/LOVE can thus all be interpreted as attention-getters. Chimpanzees generally make use of such attention-getters. They are behaviours that have no referential meaning but are effective in getting the attention from their conspecifics and from humans (Tomasello, 1990).

With the information that exists, there is no possibility of confirming the interpretation of the use of DIRTY as an insult. However, since the published reports by Fouts, DIRTY has turned into an official insult, the expression of dislike and negative

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[316] In Table 3.2 of 1989, the Gardners and Nichols, say at the description of the PCM for Washoe's DIRTY that she did the contacting of the hand to the chin "often forcefully so that teeth click together audibly" (p. 116).

[317] This sign had been the name-sign for GEORGE, one of the caretakers at Oklahoma. Fouts reports that later this sign got to be used not just to draw George's attention, but also that of other humans. It was a useful sign for this purpose because of its noise production. Fouts then re-coined this HAT/GEORGE sign as PERSON, and suggested that it was equivalent to the English gloss of "Hey you!". This last gloss may be a nice human description of the intention the chimpanzee has when using such noisy signs, but the words "hey" and "you" combined suggest a more linguistic interpretation than is warranted by the attention-getting, unreferential nature of these signs.

emotions towards someone. This has had unfortunate consequences in especially the Bodamer studies on private signing (see also section 3.2.). There, any time that one of the chimpanzees used DIRTY, and HUG/LOVE as well, the utterance was immediately assigned to the Expressive category, that is expressing emotions.[319] With no systematic data to confirm this interpretation of the sign, a possibly unjustified attribution is made to the chimpanzees, that is, that they use signs even privately to refer to their emotions. Whereas what may have happened is that the chimpanzees were using DIRTY and HUG/LOVE to call and draw the attention of the humans in the building. Both being very useful noise-producing signs, the chimpanzees may have tried to get the humans to come back during these hours of remote videotaping. At those times no humans were allowed to be and interact with the chimpanzees, causing them a deprivation of this fun form of spending their time. However, the humans were still in the building, and the chimpanzees may have been well aware of this by hearing them doing their things.

Private signing.

Evidently, some of the reported private signing consists of instances in which the chimpanzees name things to themselves. However, it may be clarifying to look for a different explanation than an intrinsic motivation to name here too. This is because it is strange that the naming occurs while the chimpanzees are not in communication with others. According to Terrace the intrinsic naming behaviour of children is, in contrast, *social* and *communicative* in nature.

Another explanation for the private signing may be that the chimpanzees are rehearsing the signs. It is known for children that their private speech in the form of bedtime monologues often function as exercises of the language they are acquiring (Frijn & De Haan,

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[318] Fouts, Hirsch, and Fouts (1982) already mention that "when Washoe signs *hug* vigorously, her hands touch her arms with such great force that a short 'thumping' sound can be distinguished over almost any noise. ...when she signs this to humans they pay attention" (p. 184).

1990). The chimpanzees may also be practicing their signs, how to form them and how to relate them to their referents. Indeed Beatrice Gardner, in response to questions on a conference (Gardner & Gardner, 1972), explained that an important function of private signing was to practice the signs. She said that Washoe "sometimes ... repeated one sign over and over again, and this would tend to be one of the signs that she had learned very recently" (p. 264). And also: "While we sat quietly in the other room, waiting for Washoe to fall asleep, it was common to see her practicing her signs, just as Ruth Weir has reported for young children." This behaviour may not be a conscious practicing of the signs' forms and their relations to referents. It may also be that, should the signs function as conditioned responses rather than symbols (see the discussion in chapter 5), the private signing gets evoked by certain stimuli, causing the chimpanzee to produce signs in a more or less automatical manner. Another possibility might be that the private signing is a more or less meaningless after-effect of being exposed to human signing the whole day and experiencing a myriad of requests to sign from the humans every day.

Several methodological criticisms of Bodamer's assignment of the instances of the chimpanzees[319] private signing to the categories of private speech in humans were given above and in section 3.2. Additional criticisms are the following. A major problematic rule is that any utterance with a sign about an object that is not present in the context, is assigned to the Informative category. Within Furrow's system, in this category the children explicitly referred to objects and events that were not there. The example given is "Daddy at work." A clear expression of even the place where the absent "daddy" is. However, to put any chimpanzee utterance with a sign of an object or event that is not present in this category, is to suggest, again, possibly more than is justified. It would be a different matter if the chimpanzees would regularly make such utterances as in the child example just given, for example, if they signed things like ROGER WORK HOME or GIMME FOOD IN BOX IN

[319] Without any further justification it is then said that "Signs used by these chimpanzees that meet this classification are HUG/LOVE, SMILE, CRY, and DIRTY" (p. 287).

KITCHEN. Without paying attention to other explanations of private signing (such as practicing or meaningless repetition), any sign about an absent object or event is interpreted by Bodamer to mean that the chimpanzee is thinking and expressing something about the object or event that is somewhere else in location.[320] Take a situation where, for example, during a particular day the chimpanzees have been exposed to many human modelings of the signs GRAPE, MEAT, and POPCORN, and they are then later practicing or repeating these signs. In Bodamer's rule the instrumental practicing will then get to be transcended as thoughts of the chimpanzees about these objects. This is not to say that the chimpanzees will never request objects and actions that are not currently present. It is known from other studies that chimpanzees can well think about things that are not present (Byrne, 1995). Terrace also mentions that Nim asked for goods and services not already there at the moment. The exact criticism here of the private signing studies then, is that any instance of a sign whose referent is not present in the context, *automatically* gets to be assigned to the Informative category.

Another rigorous rule in Bodamer's categorization of private utterances that may be unjustified concerns the Imaginary category. It appears that an utterance was considered to be Imaginary whenever a sign was used in connection with an object that was not the actual name of that object: SHOE for a hose, and DRINK for a waterballoon (see page 178). However, the chimpanzees may simply have been making mistakes in these instances. Loulis' DRINK in the example may have been a reference to the water inside the balloon, rather than that he was imaginatively transforming the balloon. Only a further substantial study of possibly imaginary behaviour or sign use could give more insight on this aspect of chimpanzee behaviour.[321]

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[320] Indeed, Fouts, Fouts, Abshire, and Bodamer (1991) call the instances in the Informative category "strong evidence that just like us, the chimpanzees also think about things that are not present" (p. 4).

[321] Jensvold did her thesis study on imaginary play behaviour in the chimpanzees (Abshire, 1989). She claims to have found six instances, five of which included signing. The examples are not that clear, however. Thus, Dar signing TICKLE on a stuffed bear and on a puppet (if this was indeed signing and not exploring the toys with his index) were interpreted to be "definitive examples" of animation, that is, ascribing living characteristics to an inanimate object. The context of the examples does not show this to be as definitive. Other interpretations might account for the behaviour. A larger study with more extensive discussion of the context is needed to provide more information on this subject.

Further problems show up when examining the results of the first study on private signing (1987). It is interesting to note that almost a quarter of all the instances consisted of Dar using the sign PEEKABOO, made 22 times or in 24.2 % of the total. It is, however, unclear whether PEEKABOO was made here as a referential sign. PEEKABOO is made by the palm of an open hand touching and covering the eyes or eyes and nose. Dar has been observed to be using this behaviour as part of a game routine, that can also be carried out privately, where he makes somersaults while every now and then putting his hand over his eyes, as in the sign PEEKABOO.[322] Dar may just have been playing this game with himself, rather than that he was Describing his Own Activity, as it was classified into Furrow's categories. If his behaviour was not private signing but unreferential play behaviour, then almost two thirds of the instances supposed to be Dar's private signing in this study have to be left out of the analysis, as PEEKABOO took up 65.6 % of his sign use here.

The next most frequent sign in the 1987 study was DIRTY, which also took up nearly a quarter of all the times a sign was used. It was made 21 times, or in 23.1 % of the total. Of particular interest is that it is mentioned that DIRTY was often directed towards the camera or the door of the chimpanzee's enclosure. This suggests, as was said above, the use of DIRTY to call and draw attention by its noise-making quality, rather than it being used as an expletive or insult. Combining PEEKABOO and DIRTY, almost half of the instances of private signing in the study may in fact not have been a referential use of signs, thus not justifying their classification into categories of private speech or signing.

Conclusion.

In this subchapter the following additional problems of method and interpretation were discussed. Signs were often taught and tested on the same days. This may have led to certain signs passing the reliability criterion because the chimpanzee remembered what sign was

[322] Bodamer (1987) describes this game: "Dar usually made this sign while he was involved in solitary locomotor play. He would typically make the sign PEEKABOO and then pirouette in a "Blindman's Bluff"

made by the human only a short while ago. Several signs (COME/GIMME, HURRY and OPEN) were (almost) identical to natural communicative chimpanzee gestures. Considering these gestures as signs leads to an inflation of the apes' sign use.

The later "interpretation-free" method of the Gardners to assign two-sign combinations to the categories of semantic relations has some considerable problems. Its automatic classification method does not look at the context in which the combinations were made and thus leaves out an interpretation of the sense of the combinations. The method thus can lead to unjustified categorization as semantically related when unrelated sequences of sings are produced.

Several discourse studies suffered from methodological problems. The higher presence of imitation in a drill setting in comparison with a conversation setting is an artifact of the design of these studies. This is because the many human questions in the drill setting made it less possible for the chimpanzees to produce spontaneous utterances and gave more opportunity for imitation. Other problems are that a lower incidence of imitation is sometimes interpreted to be conversationally appropriate while it is not taking into consideration whether the chimpanzees know how to imitate certain human signs that are absent from their own vocabulary. Also, quantitative analyses were usually made, without taking into account the contents and nature of the chimpanzee utterances.

Criticisms are also possible on some of the results and conclusions on the chimpanzees' communicative intentions. One problem is that no distinction is made between requests for objects or actions and requests for information in the interpretation of the chimpanzees' signed questions. Also, the chimpanzee-to-chimpanzee signing still can be seen as request-oriented, because the chimpanzees generally make action requests to each other. Certain problems also exist in automatically assigning utterances with signs such as DIRTY, HUG/LOVE as expressing internal states or insults. The private signing of the chimpanzees may be a form of practicing or (possibly meaningless) repetition, rather than signing that goes

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fashion around the room" (p. 50).

beyond requesting. Specific rules used in the study of this subject are problematic. Automatically assigning each utterance with a sign about an absent object or action as Informative may be inappropriate. Furthermore, sometimes unreferential play behaviour (PEEKABOO) may be wrongly interpreted as privately uttering referential signs.

CHAPTER 4

STUDY OF THE RECENT SIGN USE OF FIVE SIGNING CHIMPANZEES

1. INTRODUCTION

In Chapter 2 the various results and conclusions of the two groups of investigators studying the signing chimpanzees were presented. It is striking that such strong differences of opinion exist between the two groups. It is not just that the different projects' findings, and the implications drawn from these, only pertain to minor differences in conclusions. In most cases, and especially where it concerns the important issues of combinations of signs, the role of imitation, the communicative intentions of the signing chimpanzees, and the question whether their behaviour can be described as language, the two different groups have quite opposite conclusions.

If one looks at the nature of the respective claims of the different groups, one can notice the following. In general, the Terrace group concludes that the signing chimpanzees have not learned a really new behaviour. They are producing signs, but on the whole they have remained the same chimpanzees as before: they are not interested in verbal communication of information, but are focused on acquiring things and manipulating others. The Gardners and Fouts, on the other hand, claim that their results show that these apes have acquired a behaviour that was not part of their behavioural repertoire before: language. The apes use signs to transmit meaningful messages. Their utterances are comparable to human children's first sentences. The apes communicate information, ask questions and even

explicitly express their emotions and other internal states. These claims therefore go much further than everything that had been known up to then about chimpanzee behaviour. One might characterize the different groups as that Terrace and his colleagues said that nothing new was found on chimpanzee behaviour, whereas the Gardners and Fouts claimed to have found evidence of never before suspected abilities and behaviours in this species of great apes. Thus the gap between the two groups is big. Looking at these widely different conclusions by themselves, it is difficult to make a decision as to which group is correct, or closer to the truth.

It is here then that the empirical findings start to play a most central role. Any claim or conclusion has to be backed up by good empirical evidence, coming from methodologically sound experiments and analyses. In Chapter 3 several major problems of method and interpretation of the projects were presented and discussed. The unreliable nature of anecdotes and individual observations makes it difficult to use these as material on which to build one's claims. Perception and memory errors can result in the human observers incorrectly reporting sign behaviour, which then leads to a misrepresentation of the chimpanzees' signing. Also, these observations do not carry reliable information on the human signs within the interaction. There is therefore no safeguard against imitation in these reports. The Terrace team were highly critical of using such anecdotes and observations. Especially after their video analyses where many unknown aspects of the apes' sign behaviour were uncovered (such as the strong presence of imitation). The Gardners and Fouts, however, though they made more use of videotaping in later years, did not agree with the fallibility of these observations and kept using these reports in their descriptions of the chimpanzees' signing.

Another, though related, problem has been the use of incidental occurrences without using systematic analyses of large corpora of utterances. In order to arrive at the most plausible interpretation of the chimpanzee utterances, one needs information that is derived

from corpora analyses that points out how a sign is generally used. This is especially important for the interpretation of the sign combinations and the communicative intentions of the chimpanzee utterances. Terrace and his colleagues collected large corpora whose analyses led to important conclusions. Many corpora analyses were published in their articles. They found that seven signs showed up in an disproportionately large percentage, indicating their use as wild card signs. Also, it was shown that there was a very large degree of overlap between utterances consisting of different numbers of signs. The Gardners and Fouts also collected corpora, but published these to a lesser extent. In their Wh-question analyses the Gardners generally did not present details on the exact answers of the chimpanzees, but usually limited themselves to quantitative information in the form of the percentage of the target category.

Problems exist with regards to the interpretation of the chimpanzees' communicative intentions and general intrinsic motivation to use the signs, because of the role that drill and enforcement of signing played in all the projects. All chimpanzees were subjected to drill sessions and signing lessons almost every day. Also, they were asked many questions, usually in routine question-answer patterns. The humans made it clear that the chimpanzees were obliged to answer these questions. Use of rewards and punishment when not cooperating also took place. All of these forms of treatment of the chimpanzees may have depressed their intrinsic motivation for using the signs and fostered an extrinsic one to satisfy the questioning humans and to get what they want from the humans. Additional problems of method and interpretation exist, which are mentioned in section 3.4.

Taking all of these problems into account, many published data on chimpanzee signing are not backed up by solid and reliable material. This pertains particularly to the claims made by the Gardners and Fouts. In general, the Terrace team kept itself close to the video analyses they had made. It is therefore a matter of course, in the overall analysis of this

field of research, to give more credit to Terrace's results and conclusions and to assess many of the claims of the Gardners and Fouts as insufficiently proven.

However, it may also be worthwhile to do a new analysis of the Fouts' chimpanzees signing behaviour. This time taking the methodological shortcomings of previous studies into account, and making up for these by trying to employ only rigorous and systematic, reliable methods. In close contact with Roger and Debbi Fouts a study was therefore set up with the goal to gather an abundant set of data of the signing of the chimpanzees in recent years. The focus of this new study was on the main aspects of the chimpanzees' use of signs: individual signs, signs in combination, as well as the underlying communicative intentions of the sign utterances.

Two methods were central in the study: the consistent use of video material, and the collection and systematic analysis of corpora of the chimpanzees' sign use. These methods were in line with recent research methods used by the Fouts and their students at the CHCI. As was shown in section 3.2., since Debbi Fouts' study with remotely controlled videocameras on the chimpanzees signing amongst themselves, the videotaping of the chimpanzee subjects' behaviour had become standard. The use of corpora has been in use for a long time already, though it had not been the only method of analysis applied. Also, only certain aspects of a corpus were usually analyzed, not enabling a comprehensive picture of the chimpanzees' overall sign use.

Using videotaped material only would solve the problem of possible perception and memory errors that are involved when basing one's conclusions on anecdotes. The existence of videotapes of interactions between humans and chimpanzees would make it possible to repeatedly watch a certain segment of film over and over again, if this should be necessary for optimal identification purposes of both behaviour and signs. Alternating between watching the tapes in slow motion and real time would also make it easier to identify the exact signs the human or chimpanzee was making at a particular time. Also, by filming both

the ape and the human he or she interacts with, it is possible to analyze whether the utterance of the chimpanzee is spontaneous, imitation, expansion, or reduction. Lastly, as will be discussed in the Method section (4.2.), the contingent utterances of the interlocutor or conversation partner are an additional factor in determining the communicative intention of the chimpanzee's utterance. This also shows the importance of filming the human interlocutor as well.

Making use of corpora of sign interactions between the humans and the chimpanzees also ensures a better picture of the way the signs are used on an everyday basis, in different situations and places. As was discussed, only looking at incidental occurrences of sign use can distort the perception of the nature of sign use by these chimpanzees. Using large corpora enables a systematic analysis of each sign that was used, the combinations of signs, and the role a signed utterance has within its context.

With the helpful assistance of the Fouts and their students, three corpora of filmed sign interactions between the chimpanzees and the humans of the CHCI were made available for systematic analysis. These were all of a recent time period. They covered three years: 1992 to 1994. In two of these corpora, the human side of the interaction was somewhat structured. It was therefore decided to collect an additional corpus, which was carried out by filming unstructured human-chimpanzee interactions from Spring to Fall of 1999.

The research questions of the study were:

- What signs are recently used by the signing chimpanzees and what possible semantic categories do these belong to?
- What combinations of signs are recently made by the chimpanzees and is there any semantic or grammatical structure in these sequences? Are semantic relations between signs present and do order preferences exist?
- What are the recent communicative intentions of the chimpanzees when they use signs?

It was hoped that the large body of reliable empirical data to be collected and analyzed in this study would shed some light on the different issues of controversy concerning the chimpanzees' sign behaviour. Any result or conclusion coming from this study would inevitably pertain to the chimpanzees' sign use in the recent corpora only, however, because only filmed corpora of a recent period could be used. The results of the study will therefore not provide new information on the nature of the chimpanzees' signing in the early years. Having these new results, though, provides empirical findings in the form of patterns and regularities in the chimpanzees' sign behaviour, together with lines of thought that further clarify the interpretation of this behaviour. This may then be of use in the reflection on the chimpanzees' early sign use, and thus clarify the debate in the ape language controversy at large.

In chapter 4.2. the methodology of this study will be described in detail. In 4.3. the results will be presented. In the Discussion in Chapter 5 the results of the study will then be related to the discussion on the sign behaviour of chimpanzees.

CHAPTER 4

STUDY OF THE RECENT SIGN USE OF FIVE SIGNING CHIMPANZEES

2. METHOD

1. Material.

1.1. Outline of study.

This study focused on the recent sign use of the signing chimpanzees at the Chimpanzee and Human Communication Institute (CHCI) in Ellensburg, Washington. The five chimpanzee subjects were Washoe, Moja, Tatu, Dar, and Loulis. Videotaped conversations between the chimpanzees and their longtime human companions from the last 10 years were used as research material. These were analyzed on the following aspects: the particular signs the chimpanzees used and their frequencies; the combinations of signs in the chimpanzees' utterances and their possible semantic and grammatical structure; and the communicative intentions the chimpanzees most probably have when they use the signs (determined at utterance level). The analyzed conversations between the chimpanzees and their human companions were spontaneous in nature, more or less unstructured, and representative for the chimpanzee-human interactions in Ellensburg. They were taken from four different types of corpora introduced in sections 1.3.1 to 1.3.4.

Explanation of the terms "conversation" and "utterance."

The interaction sessions collected in the four corpora are called *conversations* for the sake of convenience. The term is in no way intended to imply a linguistic conversation. Analysis of these conversations will allow for a determination of a possibly linguistic nature of the conversations. To call them linguistic in advance would prejudge their status. The word conversation then, should be understood as referring to the particular chimpanzee-human interactions in which both chimpanzee and human are making signed utterances.[323] A few words of caution should also be spent on the term *utterances*. This word too usually implies linguistic types of utterances, even when they are used to describe children's earliest productions of words or signs. In this study, however, the term utterances is another convenient way with which to refer to the sign communications of the chimpanzees of one or more signs, without an implication that they are linguistic in nature.[324] For an explanation of the term *signs* used throughout this dissertation, see the remarks in chapter 1 and chapter 2.1. (footnote 57). This term is also used for convenience's sake and does not imply a sign from ASL or any other human sign language.

1.2. Subjects.

The study was carried out with the five signing chimpanzees at the Chimpanzee and Human Communication Institute of Central Washington University in Ellensburg, Washington. In Table 4.1 the biographical information for each of the chimpanzee subjects is given: name, sex, their taxonomic classification, the date and place of birth, and the places and periods in which they were part of the sign language research by the Gardners and Fouts, respectively.

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[323] In several publications Terrace (1983; Terrace, Petitto, Sanders & Bever, 1980) used the word *conversations* in quote marks, "conversations," to refer to human-chimpanzee sign interactions that in his view were not linguistic in nature. In the description of the study in this dissertation the word conversations might similarly be put in between quote marks to indicate that the word does not suggest linguistic types of conversations. However, because the term will frequently be used throughout these pages it is considered less annoying to use the word without quote marks.

Table 4.1 Biographical information for each chimpanzee.

Name	**Washoe**	**Moja**	**Tatu**	**Dar**	**Loulis**
Sex	female	female	female	male	male
Taxonomic classification	*Pan troglodytes troglodytes*	*Pan troglodytes schweinfurthii*	*Pan troglodytes troglodytes*	*Pan troglodytes verus*	*Pan troglodytes troglodytes*
Birth date	9/65 (est.)	11/18/72	12/30/75	8/2/76	5/10/78
Birth place	West Africa	LEMSIP*	IPS*	Holloman*	Yerkes*
Univ Nevada	6/66 – 10/70	11/72 – 12/79	1/76 – 5/81	8/76 – 5/81	---
Univ Oklahoma	10/70 – 9/80	12/79 - 9/80	---	---	3/79 – 9/80
CWashingtonU	9/80 -	9/80 -	5/81 -	5/81 -	9/80 -

Based on Table 9.1 of Fouts & Fouts (1989).

*: Birthplaces:

- LEMSIP: Laboratory for Experimental Medicine and Surgery in Primates, New York.
- IPS: Institute for Primate Studies, University of Oklahoma.
- Holloman Air Force Base in New Mexico.
- Yerkes Regional Primate Center, Atlanta, Georgia.

1.3. Corpora.

The recent sign use of the signing chimpanzees was studied by making use of four different corpora of conversations between the chimpanzees and the humans, dating from the period 1992-1999. All these conversations and interactions had been videotaped. The corpora came from four different sources from the past 10 years. Three were taken from graduate or dissertation studies by students from the CHCI: the Kennerud, Bodamer and Jensvold studies. Each of these was already introduced in chapter 2.3. In two of these studies, the conversations contained some prescripted structure on the part of the human conversation partner. In order to have an additional corpus of representative conversations in which the behaviour of the human interlocutor was not bound by any instructions, as well as to cover new places within the chimpanzee compounds that had not been filmed in the other corpora, the author collected new material in 1999, presented here as the *1999* corpus or Rivas conversations.

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[324] In her descriptions of the orangutan Chantek's sign productions Miles (1983) also explicitly mentioned that she used this term for convenience's sake. Dupré (1991) similarly made the relative status of the word explicit.

The corpora from the Kennerud, Bodamer and Jensvold studies were used as the material for this study, because these were the only studies of a recent date that provided a large videotaped corpus of human-chimpanzee interactions that were relatively unstructured, relaxed, and representative for the daily contact between the humans and the chimpanzees at the CHCI. All three corpora were thus useful for analysis, both in terms of the communicative intentions underlying the chimpanzee utterances,[325] as well as for systematic analyses of the (combinations of) signs used by the chimpanzees in recent years.

In the four corpora the chimpanzees interacted with humans who had worked with them on a long-term basis. These interactions between the chimpanzees and well-known and familiar human companions were the most useful material to study the chimpanzees' use of signs. This is because one can expect their signing to be most representative when they communicate with these humans, rather than when they interact with lesser well-known and more inexperienced humans. Because the object of this study was to gather as much information as possible on the nature and scope of the recent signing behaviour of these chimpanzees, interactions with familiar humans could be expected to offer the best approximation of their general use of signs.[326] The choice for long-term human companions also had advantages in terms of proficiency in ASL or sign communication. The longer these humans had worked with the chimpanzees, the better their mastery of sign language had become. The presence of these more fluent human interlocutors provided a better environment for the chimpanzees to show the full range of their signing behaviour than when they would have interacted with sign language novices.

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[325] In studies on children's communicative intentions it is considered important to study the children's utterances in an unstructured, relaxed, and naturalistic setting (Coggins & Carpenter, 1981; Coggins, Olswang & Guthrie, 1987; Dore, 1974, 1975a; Roth & Davidge, 1985). This allows for the expression of a variety of different intentions. Structured settings might only evoke certain specific intentions, such as answering or naming, and would not show the full range of communicative intentions a child (or ape) is able to encode.

[326] The importance of using interactions with well-known and familiar individuals has also been stressed in the study of communicative intentions in children (Coggins & Carpenter, 1981; Coggins, Olswang & Guthrie, 1987; Dore, 1974a, 1975; Roth & Davidge, 1985). It is in this set up that one can expect the best representative sample of their intentions.

The relevant aspects for the author's study of the design of each of the four different corpora will now be described.

1.3.1. The *1992* corpus.

Vicki Kennerud, a graduate student of Roger Fouts, videotaped interactions between the chimpanzees and humans in the Summer of 1992, when the chimpanzees were still housed on the third floor of the Psychology Building. Here they had no outdoor enclosure and their indoor cages were smaller compared to the enclosures the chimpanzees now have in the new building of the CHCI. Kennerud's study examined the differences between a conversational and a drill setting (see chapter 2.3. for a further description of her study and its findings). The conversations took place in the "playroom" because this was often used for human-chimpanzee interactions, and because it was most accessible in terms of filming these interactions. The human interlocutors in the study were two graduate students, enrolled in the Experimental Psychology program at Central Washington University (CWU). Both had taken at least two quarters of American Sign Language at CWU. One interlocutor had started working with the signing chimpanzees in September, 1989, and the other in September, 1991. They were not informed of the purpose of the study and were only told to have drill or conversation sessions with one of the chimpanzees at a time (practice sessions trained the interlocutors in the drill protocol).

During the sessions the humans had with them a picture book, made of photographs cut from magazines, and a bag containing objects familiar to the chimpanzees, such as a brush, a stuffed dog, paper, and toys. The objects and picture book were chosen from those that the chimpanzees were regularly given and were the same in all of the sessions in this study. The presence of these objects corresponds with the methodology of child studies on communicative intentions. In these studies the presence of toys and other objects is

considered to help in making the interaction more representative as well as more varied than when communicating with each other in a barren environment.

Sessions were conducted on weekdays over a 27 day period (July 8 - August 3, 1992) between 10 and 11 a.m. and 1 and 2 p.m. The human interlocutors first engaged a focal chimpanzee for some quiet play, grooming, or signed conversation. They then signed YOU WANT PLAY GAME? and asked the chimpanzee to go to the Playroom Tunnel. During the subsequent drill or conversation sessions the chimpanzees were in this tunnel cage on the floor of the room and the human interlocutors sat next to the cage. The maximum length of the sessions was five minutes. When five minutes had passed the camera person stopped filming the interaction.

The drill sessions of Kennerud's study were not used for the study on the chimpanzees' recent sign use, because the communication was not spontaneously initiated by the chimpanzees and the structuredness of the sessions limited the chimpanzees' responses considerably, generally only evoking the Naming category of communicative intentions. The conversation sessions, however, had no established format, and the human and chimpanzee were free to either use the objects and picturebook or not. They were also allowed to groom, tickle, or play other games (with the exception of chase, as this would disrupt the filming). The nature of the interaction in these conversation sessions again accords well with the relaxed, unstructured nature of the interactions studied in the child studies, especially those on communicative intentions. These sessions were therefore used and analyzed for the study on the chimpanzees' recent signing behaviour.

Kennerud's study contained 28 conversation sessions. Washoe participated in five of these. Moja took part in four conversation sessions and Tatu in seven. Dar also participated in seven conversation sessions, but only made signs in four of these. Loulis lastly, interacted with the human in five sessions, but made signs in only four sessions. Eventually, 24 conversation sessions were used for analysis. They took up two hours of tape. The sessions

were of a variable length, with a range going from 1 minute and 41 seconds, up to 5 minutes (which was the cut-off point Kennerud used). The 24 sessions make up the *1992* corpus, for the year in which they took place.

1.3.2. The *1993* corpus.

Mark Bodamer (1998) did a dissertation study on the initiation and maintenance of conversations by the chimpanzees (see its description in chapter 2.3.). He videotaped these conversations with himself as the human interlocutor in the chimpanzee enclosure on the third floor of the Psychology Building. The sessions were collected from April 1992 through April 1993.

Each session started in the following way. Mark Bodamer sat on a chair with his back to the chimpanzee, pretending to be working at a table by "shuffling papers, writing, or reading" (1998, p. 26). A chimpanzee then tried to get his attention by making an attention getting sound. At hearing the chimpanzee, Bodamer turned on his chair and the chimpanzee started a conversation by signing an utterance. As a result of Bodamer's research question his own first two reactions to the chimpanzee's signing were structured. His first reaction was to ask WHAT? As his second reaction or probe Bodamer had to use one of four conditions. In the 'What?' condition he asked WHAT? a second time. In the On Topic condition he asked a Wh-question related to the chimpanzee's utterance. The Wh-question condition included one of the three interrogatives WHAT, WHO, or WHERE. As an example, in one conversation a chimpanzee signed BANANA. Bodamer then asked WHAT BANANA? In the Affirmative condition Bodamer gave an affirmative response to the chimpanzee utterance. This response included the sign YES. In one example a chimpanzee signed DRINK COFFEE to which Bodamer reacted by signing YES COFFEE LOOK-THERE. Lastly, in the Denial condition, he gave a denial response, which included one or more of the signs NO, SORRY, and

CAN'T. For example, when a chimpanzee had signed MEAT, Bodamer responded with NO MEAT.

Bodamer had been working with the signing chimpanzees for 8 years prior to his study. The interactions between him and the chimpanzees were typical for daily human-chimpanzee interactions. Though the first two human utterances in each interaction were bound by the particular probes, these utterances themselves were representative of daily communications. Sometimes the conversations continued for several minutes after the probes and offered fully unstructured interactions, as the human had stopped asking the preset questions.

The same enclosure was used as in the Kennerud study: the playroom. Bodamer called this the Tunnel Room Tunnel, because it was in fact a floor tunnel connecting two of the other rooms.[327] In this place the chimpanzees "played tickle and chase, wrestled, groomed, and looked at magazines" (p. 22), and interacted with humans. From this room they were able to see the table where Bodamer sat at the start of each session. During the conversations Bodamer generally kept sitting on the chair at this desk (facing the chimpanzee after he or she had drawn his attention). A mirror was hung on the outside of the chimpanzee tunnelcage, angled in such a way that the upper half of Bodamer's body was visible if he remained seated on the chair. Thus, on film the chimpanzee was fully visible (so all chimpanzee signs and nonverbal behaviour could be seen) and at the same time Bodamer's upper body was visible so that at least his whole signing space was covered.

The interactions in Bodamer's study were somewhat different from the interactions in the Kennerud and Jensvold studies. First, they all started with the human sitting with his back toward the chimpanzees, whereas in the Kennerud and Jensvold studies the human and chimpanzee were facing each other. Bodamer's study thus provided data about the chimpanzee's signing after they had drawn attention from a human. In the Kennerud and

[327] In the publication of his dissertation with Allen Gardner (2002) the playroom was called the observation room, and the tunnels were referred to as passageways.

Jensvold studies the humans drew the chimpanzees into the conversation. Second, there were no picturebooks present in these interactions. Objects were sometimes present in the form of drinks that Bodamer was having, which were visible to the chimpanzees. Further objects were on the shelves on the walls of the playroom. This was where most of the chimpanzees' toys, clothes, and other objects were stowed away. These were out of reach for the chimpanzees, but within their eye-sight.

A considerable amount of the conversations in Bodamer's study were transcribed by another doctoral student, Heidi Shaw, and could therefore be used for the purposes of the author's research. They consisted of about five hours of tape which contained 128 interactions between Mark Bodamer and the chimpanzees. They are called the *1993* corpus, to distinguish it from the *1992* corpus. The conversations themselves had a mean duration of 62 seconds, with a range going from 13 seconds up to 2 minutes and 24 seconds. To specify the conditions of these transcribed conversations, 32 were of the What? condition, 44 of the On Topic (Wh-question) condition, 14 of the Affirmative, and 38 of the Denial condition. In this corpus all 44 conversations of the On Topic (Wh-question) condition contained WHAT as the only interrogative in the second probe. As in the example above, these were questions such as WHAT BANANA?. Questions with WHERE or WHO, such as WHERE BANANA? or WHO BANANA?, were not present in the second probe of the transcribed On Topic conversations (though these types of questions did occur at later moments in the conversations from the corpus).

The 128 transcribed interactions did not make up the total of conversations that Bodamer collected for his dissertation. He had taped about 24 hours of interactions with the chimpanzees, the majority of which were of shorter duration than the mentioned mean of 62

seconds. Shaw had mainly transcribed the longest conversations, because these were particularly useful for her own research question.[328]

In Table 4.2 the *1993* sessions are divided over the individual chimpanzees. The number of sessions of each chimpanzee are presented, together with the mean and range of duration of the conversation sessions of that chimpanzee.

Table 4.2 *1993* sessions per chimpanzee subject.

	Number of sessions	Mean duration	Range
Washoe	32	66 seconds	29 sec – 2 min 24 sec
Moja	30	63 seconds	22 sec – 1 min 37 sec
Tatu	30	1 min 17 sec	37 sec – 2 min 17 sec
Dar	36	44 seconds	13 sec – 1 min 37 sec

Loulis was not used in Bodamer's study (nor, as will be mentioned below, in Jensvold's study). This was not motivated in his dissertation. One might deduce the main reason to be that he was not cross-fostered, in contrast to the other four chimpanzees. The reasoning to focus only on the cross-fostered chimpanzees (as explicit in the title of Bodamer's dissertation) was probably to ensure that results among comparable subjects would result.

1.3.3. The *1994* corpus.

Mary Lee Jensvold (1996) did her dissertation study on the responses of chimpanzees to different types of questions (for a description of the results see section 2.3.). For this purpose she collected conversations between the chimpanzees and herself as the human interlocutor. Jensvold had 8 years of experience with this group of chimpanzees at the time, and 10 years of experience in ASL.

The conversations took place while the chimpanzees were in the outdoor and indoor enclosures of the new CHCI building. They were collected from October 1993 to September

[328] Shaw's study was on the gaze direction of the chimpanzees during signed interactions. She wrote her dissertation on this subject in 2001, which had as its title *Gaze direction in conversational interactions of chimpanzees*.

1994. The interlocutor, Jensvold, was in the human area adjacent to the chimpanzee enclosures, also called the "human cage," as well as on the berm. The chimpanzee approached the interlocutor or vice versa and a session started. The interlocutor signed with the chimpanzee "in a typical human chimpanzee interaction for example signing about activities, books, meals, or games" (1996, p. 15). As in the other two studies above, these conversations were representative and relaxed interactions about different subjects.

The Jensvold study was an expansion of Bodamer's, so the design was similarly structured on the human side. Again there were four conditions, but now three sequential turns of the human were prescribed. Each session started with the chimpanzee signing an utterance, to which Jensvold then presented three successive questions or other kinds of responses. These three responses were from one of four conditions. Similar to Bodamer's, in the On Topic condition Jensvold asked three Wh-questions related to the chimpanzee utterance and appropriate to the context. As an example of the On Topic condition, session 55 from tape 1 is now presented:

1:04:07. Tatu: TIME EAT

1:04:10. Jensvold: WHO WANT EAT?

1:04:17. Tatu: EAT

1:04:18. Jensvold: WHO EAT?

1:04:20. Tatu: TATU

1:04:23. Jensvold: WHERE EAT?

1:04:25. Tatu: MEAT

Comparable to Bodamer's 'What?' condition, Jensvold's General condition consisted of three general questions in the following order: 1) a questioning facial expression only, 2) the sign WHAT?, and 3) the utterance I NOT UNDERSTAND or the one composite sign DON'T-UNDERSTAND. An example of the General condition from the Jensvold corpus is session 23 from tape 3:

0:32:55. Moja: HURRY YOU SMELL

0:33:06. Jensvold: questioning expression (noted as Q)

0:33:06. Moja: SMELL

0:33:07. Jensvold: WHAT?

0:33:08. Moja: SMELL

0:33:09. Jensvold: NOT UNDERSTAND

0:33:10. Moja: PEEKABOO

The third condition was the Can't condition (similar to Bodamer's Denial) in which Jensvold signed "non-question negative probes," that is, utterances that contained signs such as CAN'T, SORRY CAN'T, I MUST GO. Session 59 of tape 4 is an example of the Can't condition:

1:32:07. Washoe: GIMMIE

1:32:09. Jensvold: SORRY CAN'T NOW

1:32:21. Washoe: BERRY

1:32:23. Jensvold: CAN'T GIVE-YOU THAT NOW

1:32.26. Washoe: GIMMIE

1:32.33. Jensvold: CAN'T GIVE-YOU THAT BERRY NOW

1:32.35. Washoe: PLEASE GIMMIE.

Jensvold's last condition was the Disruptive one. In this new condition she also asked three Wh-questions. However, in contrast with the On Topic condition, this time the questions were unrelated to the chimpanzee utterance or to the general context of the interaction. The questions disrupted the ongoing conversation. These were examples of the disruptive questions: WHO STUPID? WHERE DOG? and WHERE FUNNY GIRL? The following is an example of a session in the Disruptive condition. It is session 4 from tape 5.

0:08:45. Washoe: FRUIT GIMMIE

0:08:49. Jensvold: WHO FUNNY?

0:08:51. Washoe: WASHOE

0:08.54. Jensvold: WHERE CAT?

0:08:56. Washoe. WASHOE (then, at 0:09:00: GIMMIE)

0:09:03. Jensvold: WHERE CAT?

0:09.05. Washoe: GIMMIE

As in the Bodamer study, the presenting of these probes brought an element of structuredness into the conversations. However, again, similarly as with Bodamer, the different categories of probes were representative of typical human chimpanzee interactions.

About 8.5 hours of videotape were filmed, comprising of a number of 366 conversations. Eleven of these conversations were not used for the purpose of the author's study because of poor visibility. Therefore, 355 sessions were used for analysis. They are called the *1994* corpus, again, to distinguish it from the other corpora. Table 4.3 gives the number of sessions per chimpanzee and per condition of the Jensvold conversations that were analyzed in this study.

Table 4.3 Number of used *1994* sessions per condition per chimpanzee.

Chimpanzee	General	On Topic	Can't	Disruptive	All conditions
Washoe	19	19	22	24	84
Moja	25	23	21	20	90
Tatu	27	27	22	28	104
Dar	18	19	20	20	77
All combined	89	88	85	92	355

Loulis was not included in this study because he did not participate in the pilot trials for the study. Jensvold added to this that Loulis "initiated signed interactions with humans less often than" the other chimpanzees (1996, p. 14).

The conversations themselves generally lasted only 30 seconds (for the purposes of Jensvold's study the conversation only needed to make seven turns, so the filming usually

stopped at that point). The range of duration of the conversations was from 6 seconds up to 53 seconds.

1.3.4. The *1999* corpus.

The conversations in the three above-mentioned studies were representative of the daily chimpanzee and human interactions at the CHCI and were therefore very useful for the purpose of this study. All of these conversations were also naturalistic and unstructured in nature. However, in the Bodamer and Jensvold study an element of structure was present on the part of the human interlocutor, in the form of the prescribed reactions or probes. Though these reactions were actually representative of many chimpanzee-human interactions, it meant that some structure was present within these conversations. In the conversations of the Kennerud study the humans were not bound to any previously instructed rule. They were free to react to the chimpanzee in whatever way they liked. The author decided to collect even more conversations without any previously set up structure on the side of the human. All that was said to the human interlocutors in these new conversations was that they should behave as naturally and normally as they could.[329] They were not told about the purpose of the study. However, as it was obvious that the subject of the study had to do with the signing of the chimpanzees, the human interlocutors might feel responsible to evoke their signing. An explicit remark was therefore made, stating that it was not important whether the chimpanzee(s) came to interact or sign at all with the human. If no signing or even no interaction ensued, this was O.K. This statement was meant to function as a relief for the human interlocutor from pressure to ensure that interacting and signing took place.

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[329] Roth & Davidge (1985) mentioned the importance of the absence of any previously set up structure, in particular for the study of communicative intentions. In their study: "to facilitate natural and spontaneous mother-child interactions, instructions were minimal. Each mother was requested to play with her child as she would normally do in her own home" (p. 354).

Of course it may have been the case that some structure was still present in the 1999 interactions: Some humans may relate to the chimpanzees according to some sort of structure, for example, they may ask Wh-questions as a way of reacting to chimpanzee utterances. However, because the human interlocutors were not bound to any prescribed reaction, the opportunity for more relaxed and naturalistic interactions was bigger than in the Bodamer and Jensvold study.

These new conversations were dubbed the 1999 conversations, in order to make comparisons easier with the three other studies. They were collected in four representative locations and situations: during mealtimes, on the "berm," in the "human cage," and during "chimpcare" shifts. These four situations will now be described.

1. Mealtime interactions. The chimpanzees are given the following meals each day: breakfasts, lunches and dinners (for descriptions see D. Fouts, 1994, Fouts & Fouts, 1989). These are served in the chimpanzees' quarters in the nightcage enclosure. Breakfast is given between 8 and 9 a.m. It is the first interaction routine of the day between the humans and chimpanzees of the CHCI. Before the actual breakfast itself is served, the chimpanzees are first asked to push through or below the caging of their nightcage area, the sleeping blankets, burlap sacks, toys, magazines and other objects they had with them during the night. The breakfast routine then starts with giving the chimpanzees some vitamin pills through the bars. This is followed by giving them what are called monkey chows. These are chunks of prefabricated special food for captive primates, containing many vitamins, minerals, and other essential nutrients. They then get a fruit drink called a "smoothie." The name refers to its texture: a smoothie consists of blended fruits and vitamins that make a thick and rich drink. The smoothies are given in plastic beakers, pouring the liquid substance straight into the chimpanzees' mouths. Usually the breakfast is finished with several pieces of fruit, such as bananas. Lunch takes place between 12 a.m. and 1 p.m. The lunch routine starts with more monkey chow chunks, followed by a plate with the dish of that day, given in a bowl with a spoon that is shoved below the caging.[330] This usually consists of soups of bean, split pea, or lentil, with vegetables and spices. In the CHCI care is taken to have a variety in the dishes that are given as lunch or dinner. Having a different type of dish for lunch or dinner each day provides for more enrichment of the chimpanzees' daily lives. Lunch is topped off by several fresh pieces of raw vegetables and sometimes yogurt or peanuts. Dinner is served from about

[330] The serving of food in a bowl with a spoon is a remnant of the time that the chimpanzees were cross-fostered. The chimpanzees actually use the spoon, though not always, to eat their lunch or dinner.

4 p.m. onwards, which is the time when the chimpanzees come in for the night from their outdoor and indoor areas to their nightcage enclosure. Here again, monkey chow is given first. Then the main dish of the dinner is served in bowls. It usually is a dish based on grains such as rice, or cooked cereal such as oatmeal, together with steamed or cooked vegetables. Often it is tried to make the dinner into something special, such as pizzas, sandwiches, potato salad, or Mexican dishes (tortillas and beans). Sometimes meat is given, such as tuna, beef, or chicken. A special treat that is sometimes given as dinner are heaps of popcorn put in large plastic bags on top of the caging of the ceiling of the nightcage area. The chimpanzees then have to tear the bags apart through the bars and then forage for the popcorn (the same is occasionally done with lettuce leaves). Sometimes a drink is also given at the end of dinner. After dinner the chimpanzees stay inside the nightcage area, and are given things for the night, such as blankets and burlap sacks to lay on, magazines to look at, and toys and other objects to play with and manipulate.

The filmed mealtime interactions resulted in 55 usable conversation sessions. They had a mean duration of 24 seconds. In these interactions, besides giving meals and communicating about these, the human and chimpanzee also had other sign interactions. For example, in one of the sessions a chimpanzee and a human signed about a lipstick. The human then let the chimpanzee smell it and put some lipstick on the chimpanzee's lips. A mirror, a watch, toys, magazines, the human's shoes, and other objects were also part of several interactions. Sometimes short chase games took place. In one session the human manipulated, shook, and blew air through her hair for a chimpanzee. In filmed quiet moments right after dinner, grooming by the chimpanzee of the human's arm took place through the caging. The human also brushed the chimpanzee with a brush. Peekaboo was played as well, by the human putting her hands in front of her eyes. In another game that occurred, especially with Loulis, the human put his or her feet to the caging, which the chimpanzee then briefly touched, after which both moved playfully about. Another specific interaction, that mostly

took place in the berm and human cage interactions, but also several times during mealtimes, was the "blowing breath" routine. This was initiated by the chimpanzee asking SMELL. The human then blew his or her breath through the caging to the chimpanzee's nose, so the chimpanzee could smell it. This routine has originated somewhere in time and has become a daily form of interaction between the chimpanzees and the humans at the CHCI.

2. Berm interactions. The berm is the human area encircling the chimpanzees' outdoor enclosure. Besides a footpath for the humans, the berm also contains a "garden" with all kinds of fruit and vegetable plants. The chimpanzees are given access to the outdoor area between 9 and 12 a.m. in the morning and between 1 and about 4 p.m. in the afternoon. The chimpanzees' outdoor area is 5000 square feet (465 m^2). It has a wire-fenced dome, the height of which goes up to 32 feet or 10 meters. In the outdoor enclosure are plants, climbing poles and structures, hanging fire hoses, earthen terraces, cargo nets in which the chimpanzees can lounge, a "treat mound" with holes from which they can dig out goodies with tools (branches and sticks), and a small cave where they can find privacy (see Figure 4.1.). There are also several waterspigots and a toilet. In the outdoor area the chimpanzees can also see the world outside. They can see the campus area where the CHCI building is located and the cars and people passing by. In the distance they can see more of the town of Ellensburg and the Kittitas Valley in which this town is located, and in the farther distance the foothills of the Cascades mountains. There is always a human on the berm when the chimpanzees have access to the outdoor area. This is for security reasons and for the chimpanzees to have a human companion to interact with.

Berm interactions were collected in both mornings and afternoons. Of the interactions filmed, 24 conversation sessions could be used for analysis. They had a mean duration of 1 minute and 54 seconds. In these filmed berm sessions the following sorts of interaction took place. The human and chimpanzees played chase together. The human brushed the chimpanzee through the bars of the caging. The chimpanzees asked for pieces of the

Figure 4.1. Moja and Tatu using branches to get to treats hidden in the "treat mound" in the outdoor area. Dar is walking higher up on a terrace next to the fence through which the chimpanzees and humans can interact. © Esteban Rivas

vegetables and fruits growing on the berm and the human sometimes gave these. Another interaction form was the routine in which the human blows his or her breath to the chimpanzees, so they can smell its odour. Play with masks also occurred. Further interaction concerned some of the humans' glasses, which some chimpanzees were interested in. They asked the human to manipulate the glasses. In two sessions the human blew soap bubbles to the face of the chimpanzees who tried to catch the bubbles with their mouth. In another session a human took out her lip balm stick and put some on a chimpanzee's lips. In two sessions the human pulled on the zipper of her jacket which produced a noise that had the attention of the chimpanzees. Once a human shook and manipulated her hair for the chimpanzee to see. She also showed her shoe to the chimpanzee.

3. Human cage interactions. The human cage is an area that faces both the outdoor area and the indoor rooms. The indoor rooms are 600 square feet (56 m^2) each and three stories high. They contain terraces, climbing structures, hanging fire hoses and tractor tires, waterspigots, and a toilet. Only the humans can be in the human cage area and they can interact through the caging with the chimpanzees. The human cage interactions were recorded in the same hours as the berm interactions, in both mornings and afternoons. Of the amount filmed, 15 conversation sessions were used for analysis, having a mean duration of 1 minute and 13 seconds.

In the filmed human cage sessions the human and chimpanzees played chase games. The routine in which the humans blow their breath to the chimpanzee also took place many times. Several times the chimpanzees groomed the human's hand or arm through the caging. In one interaction a chimpanzee wanted to see more of the inside of a human's mouth and the hair on his head and body. Brushing by the human of the chimpanzee also happened. Toothbrushes were given to the chimpanzees with some edible toothpaste that the chimpanzees enjoy. Once a drink was given and in two sessions the human handed out chewing gum to the chimpanzees. In several sessions the human had a picturebook and looked at the pictures with the chimpanzees. Another human showed the chimpanzees several flowers, as well as her shoes, a hair clamp, and a bracelet. Still another human was wearing glasses, and the chimpanzee was interested in seeing her manipulate and blow air on her glasses. Manipulation by the human of zippers and velcro bands on their clothes that produced noise was another point of interest for the chimpanzees. Loulis' game of "briefly-touch-and-move-playfully about" was also played, by touching the wrist rather than the foot. Playful stamping of feet by the human was part of this game as well.

4. Chimpcare shift interactions. In the CHCI what are called chimpcare shifts take place on Saturday afternoons and Sunday mornings. Only one human then takes care of the chimpanzees, feeds them, communicates, and interacts with them. During the chimpcare

shifts the chimpanzees are in their nightcage enclosure, while the human moves about between this area and the kitchen. These sessions usually span a time of about four hours nonstop. Of the collected chimpcare shifts on video 20 conversation sessions could be used for analysis. They had a mean duration of 49 seconds.

In the filmed chimpcare shifts, the human interacted in many different ways with the chimpanzees. Brushes and combs were given to the chimpanzees, and the human also brushed the chimpanzees through the caging. Again, the chimpanzees were offered toothbrushes with toothpaste. Drinks of water were given. The human also brought out several objects to interact with the chimpanzees, such as sunglasses, lipstick, a perfume spray and drawing materials. Magazines were looked at together. Chase games also occurred. In one interaction play with masks took place. One human blew soap bubbles to the chimpanzees. Another human had put up a special treat: buckets with iced and coloured Kool-Aid put in front of the chimpanzees' cages. The chimpanzees were then given tubes that they could put through the caging into the bucket in order to suck up the Kool-Aid. This is a special enrichment technique that the chimpanzees are presented with from time to time (see Figure 4.2.).

All of the conversations in these four situations were additional new material filmed in the new, more spacious CHCI building (the Kennerud and Bodamer studies took place in the Psychology Building's smaller enclosures). They also provided material from places and times that had not been filmed in the other three studies: interactions between humans and chimpanzees during meals and chimpcare shifts in the nightcage area were now filmed as well.

A range of different human interlocutors were used who were all working at the CHCI for at least 1.5 years and had a long-term experience with ASL. There were 13 different individuals, some of whom had worked with the chimpanzees for up to 15 years. All of them regularly had interactions with the chimpanzees in all four of the abovementioned

Figure 4.2. Tatu sucking treats from a tube in the outdoor area.
Another form of enrichment. © Esteban Rivas

places and situations. They were filmed at the times that they were already scheduled to do a chimpcare shift, a berm shift, or give a meal. Only the human cage interactions were specifically set up, because there was no special human cage shift in the institute. The humans decided themselves whenever they wanted to pay a visit to the chimpanzees in this area.

Filming of meals took place at the scheduled times for these (mentioned in the *Mealtime interactions* paragraph). The chimpcare shifts similarly were bound to the set times on Saturday afternoons or Sunday mornings. Care was taken, though, not to film in the hour before a meal would start. This was done with the berm and human cage interactions as well. All of the non-meal situations were then filmed in the mornings somewhere between 9 to 11 a.m. or in the afternoons between 1 and 3 p.m., in order to ensure that the hour before mealtimes would not be the time of filming. This caution was taken in order to film times of interaction between the humans and chimpanzees in which there were no impending meals taking place. The expectation of meals, and sometimes the smell or visibility of preparations

of the meals, might influence the particular communicative intentions of the chimpanzees. Taking a limit of 60 minutes before mealtimes thus allowed a more free and pluriform expression of intentions.

Besides an absence of instructions on how to behave for the human interlocutors, a few additional differences in the setting and the method of filming were set up to increase the naturalistic nature of these conversations. In the other three studies the humans were instructed to stay put or keep seated at one particular spot. This was done for filming purposes. It can often be difficult to have both the human and the chimpanzee in a camera frame, as the chimpanzee or human sometimes move, approach or withdraw during a conversation. Besides not moving from their spot, the humans in the three studies above also had to make sure not to move too much on the particular place that they were at. They had to be conscious not to turn their back to the camera, for example, and also had to make sure that when they signed their hands were not out of visible reach for the camera. In the 1993 sessions, Mark Bodamer himself mostly had to stay put on his chair. He at least had to ensure that his signing was captured in the small mirror attached to the chimpanzee cage so that the camera filmed both his and the chimpanzee's signing.

In the 1999 conversations the humans were explicitly allowed to move about as freely as they desired. Also, rather than the human interlocutor taking care that the signing could be seen on film at all times, in the 1999 sessions the camera person was responsible for this. He or she had to move and shift the position of the camera whenever the human or chimpanzee moved, leaving the human interlocutor with his or her full attention on the interaction with the chimpanzee. The result of this design was that sometimes the human or chimpanzee moved out of the picture, or that the hands of the human were not always visible. Sometimes the angle or distance of the camera caused for an unclear view of the exact configuration, movement or place of the signs made by either human or chimpanzee. However, it was

considered a small price to pay that small parts of the conversations were unusable for analysis, in order to have conversations that were as naturalistic as possible.

There was no limit on the amount of time that was filmed. There was no cut-off point after five minutes as in the Kennerud study. The camera person stopped filming when the interaction between the chimpanzee and the human had more or less finished. At long times of interaction, such as chimpcare shifts or meals, an arbitrary decision was made to keep filming for half an hour or a whole hour, depending also on the amount of videotape still left in the camera.

The conversations were filmed from May to October 1999 with help from Quentin Davis, a fellow Ph.D. student. Filming took place by familiar humans who had been with the chimpanzees for a long time. Altogether, 6.5 hours of tape with human-chimpanzee interactions were collected. Within these hours114 separate conversation sessions could be used for analysis. They are presented here as the *1999* corpus. Their duration was very variable. It ranged from several seconds only to long sessions of interaction that could last up to 8 minutes of time. The mean of the conversations was 54 seconds.

In Table 4.4 the number of sessions per each of the four different situations is presented, together with their mean duration, and the total time of the sessions combined for each situation.

Table 4.4 Sessions per each different *1999* situation.

	Number of sessions	Mean duration	Total time sessions combined
Meals	55	24 seconds	22 minutes 3 seconds
Berm	24	1 min 54 sec	45 minutes 25 seconds
Human cage	15	1 min 13 sec	18 minutes 11 seconds
Chimpcare	20	49 seconds	16 minutes 27 seconds

In Table 4.5 the *1999* sessions are divided over each chimpanzee subject. The number of sessions per situation are given in which a chimpanzee was involved and made signs, are

given. (In a few sessions two chimpanzees signed with the human during the conversation, so the total numbers are different from the total of 114 conversations.)

Table 4.5 *1999* sessions per situation per chimpanzee.

Chimpanzee	Meals	Berm	Human cage	Chimpcare	Total
Washoe	14	5	3	8	30
Moja	15	10	5	1	31
Tatu	12	10	3	6	31
Dar	7	1	5	3	15
Loulis	10	0	1	2	13

1.4. Total hours of corpora.

The four corpora combined provided 22 hours of videotaped human-chimpanzee interactions. The *1992* corpus consisted of two hours. Five hours of the Bodamer study were used as a corpus of his interactions with the chimpanzees. All videotapes of Jensvold's study, 8.5 hours altogether, were used as the *1994* corpus. The *1999* corpus consisted of 6.5 hours.

In Table 4.6 the age of the chimpanzee subjects is given for each of the periods of the four different corpora.

Table 4.6. Ages of chimpanzee subjects in the four corpora.

Corpora	Period	Washoe	Moja	Tatu	Dar
1992	7/8 – 8/3/1992	26:10 – 26:11*	19:7 – 19:8	16:6 – 16:7	15:11 – 16:0
1993	4/1992 – 4/1993	26:7 – 27:7	19:5 – 20:5	16:4 – 17:4	15:8 – 16:8
1994	10/1993 – 9/1994	28:1 – 29:0	20:11 – 21:10	17:10 – 18:9	17:2 – 18:1
1999	5 – 10/1999	33:8 – 34:1	26:6 – 26:11	23:5 – 23:10	22:9 – 23:2

Corpora	Period	Loulis
1992	7/8 – 8/3/1992	14:1 – 14:2
1993	4/1992 – 4/1993	---
1994	10/1993 – 9/1994	---
1999	5 – 10/1999	21:0 – 21:5

*: Ages are given in years and months. The ages presented for Washoe are estimates, because her exact date of birth is not known.

2. METHOD

2. 1. Sign transcription.

2.1.1. ***1992.*** Kennerud herself transcribed all her sessions. Twenty percent or 11 of these sessions were randomly selected to assess interobserver agreement (with a minimum of two sessions per chimpanzee). The second transcriber was a graduate student in the Ph.D. experimental psychology program with the Gardners at the University of Nevada at Reno, and had over 9 years of experience with the signing chimpanzees at that time (1992). The two transcribers had an agreement of 83.03% on the presence or absence of a chimpanzee sign, and of 96.35% on the particular form of a chimpanzee sign. After this initial test the two observers met to review disagreements. Nearly half of the disagreements (42.8%) concerned the signs GIMME, THAT, and other pointing or reaching nonsign gestures. When the description of the GIMME sign was modified in that it needed a visible beckoning motion (fingers curling or wiggling toward object/recipient, or repeatedly closing and opening), the observers retranscribed the tapes and the new interobserver agreement for presence/absence of a chimpanzee sign was 86.87%.

The reliability of the transcriptions of the human signs and additional reliability checks of the chimpanzee signs have been assessed through the use of the Kennerud transcriptions as standard sign reliability tests for the students and volunteers of the CHCI. Through this process the Kennerud tapes have been watched and discussed by many different observers, most of whom had many years of experience with ASL.

2.1.2. ***1993.*** The Ph.D. student Heidi Shaw transcribed all the sessions of the Bodamer tapes that were used as the *1993* corpus in this study. At the time she transcribed these sessions, she had been working with the signing chimpanzees for 15 years and had experience with ASL for 17 years. A second person transcribed 20% of those sessions for a

reliability check. Wendy Shaw served as the second transcriber for the Washoe sessions. She too was a longtime caretaker and chimpanzee companion. She had worked for 12 years with the chimpanzees and had a same amount of years of ASL experience. Mary Lee Jensvold functioned as second transcriber for Moja and Tatu. At the time of transcription she had about 14 years of experience working with the chimpanzees and 16 years of experience with ASL. Quentin Davis was the second transcriber for Dar's signs. She had worked for 4 years with the chimpanzees and had had ASL experience for about 7 years. Finally, Mary Radeke (about 10 years of experience with the chimpanzees and about 11 with ASL) transcribed the human (Mark Bodamer)'s signs for reliability. In Table 4.7 the percentages of agreement are presented.

Table 4.7 Percentages of agreement between the different transcribers of the *1993* sessions.

	Washoe	Moja	Tatu	Dar	Human (Bodamer)
Agreement presence sign	88 %	90 %	90 %	93 %	94 %
Agreement gloss sign	95 %	95 %	97 %	96 %	95 %

2.1.3. *1994*. The transcription of the 1994 sessions were done by Jensvold herself. A second observer with two years of experience in ASL, transcribed 20% of the sessions. An agreement of 93% was reached on the human signs used as probes in the study. Another transcriber, with an experience of 12 years with the signing chimpanzees, was used to determine agreement on the chimpanzee glosses. Agreement per chimpanzee was: Washoe: 87%; Moja: 87%; Tatu: 95%; and Dar: 92%. Heidi Shaw, who had transcribed the 1993 sessions, also transcribed further utterances by the human that had not been transcribed yet by Jensvold. These were the possible human utterances preceding the trial.

2.1.4. *1999*. Two graduate students from the CHCI transcribed the conversation segments of the 1999 tapes. These were Transcribers 1 and 2. Transcriber 1 had an ASL experience of about 2.5 years, while Transcriber 2 had experience with ASL for about 1.5

years. They had both passed the sign reliability tests of the CHCI in which several sign sessions of each of the five chimpanzees have to be transcribed correctly with a correct percentage of 85. The third transcriber of the 1999 sessions, Transcriber 3, was Heidi Shaw.

Twenty percent of the 1999 sessions (randomly selected) was used for an additional test of reliability. Quentin Davis (see 4.2.1.2.) functioned as the second transcriber with all three primary transcribers just mentioned. She was called Transcriber 4. Before the primary transcribers could continue transcribing the 1999 sessions, they first had to have an agreement of approximately 85% with Transcriber 4. The results of this reliability check are presented in Table 4.8. The agreement on the presence of a sign as well as the agreement on the gloss of a sign are presented for both the chimpanzee and the human signs.

Table 4.8 Percentages of agreement between the different transcribers of the *1999* sessions.

	Tr 1 -Tr 4	Tr 2 – Tr 4	Tr 3 – Tr 4
Agreement presence chimpanzee sign	90.9 %	83.9 %	87.5 %
Agreement gloss chimpanzee sign	92.0 %	93.2 %	95.2 %
Agreement presence human sign	92.5 %	87.9 %	95.2 %
Agreement gloss human sign	97.0 %	98.4 %	94.9 %

2.1.5. Re-identifications of signs.

All transcriptions were checked by the author, using the videotapes and the official descriptions of the Place, Configuration and Movement of each sign. Sometimes one or more signs were unclear on the videotape, or the transcribed sign was doubtful and might have been better interpreted as another sign. On such occasions the author wrote down his own judgment of the sign that was more likely. When a sign was badly visible and might be multi-interpretable, the author called it an unclear sign. All doubtful signs in the transcriptions of the four corpora were then given to one of the two longtime Ph.D. students (Shaw and Davis) for re-identification. They were provided with the times on the videotape of the conversation

at which the doubtful signs were made (though only by giving the approximate beginning time and not the end time of the utterance in which the doubtful signs were made, so as not to give any further cues). They were given the original transcription, with the utterance containing the doubtful signs made blank. They were then asked to re-identify that utterance, by using the videotape. An instruction was also given that not on all occasions an actual sign had to be there at the given time. The re-identifications were then compared with the original transcriptions and the author's judgments. The method used to determine the final identification of the doubtful signs was the following. The agreement between two of the three judgments was taken as the correct one. Where all three disagreed the signs were written down as "unclear" or "unknown" in the transcription.

2.2. Frequency of signs.

The reliable sign transcriptions provided data about the particular signs that the chimpanzees used in the recent conversations. The frequency of occurrence of each sign was calculated as follows. If a sign was reiterated or repeated several times in a row within the same utterance, with no other sign made in between, the repetitions were counted as just one occurrence of that particular sign. For example, if the sign FLOWER was immediately repeated five times, FLOWER FLOWER FLOWER FLOWER FLOWER, the frequency of the sign FLOWER was just one occurrence. However, if a sign was repeated within an utterance with different signs in between the repetition, then each new occurrence of the sign within the utterance was counted as a new instance of that sign. For example, if a chimpanzee signed FLOWER FLOWER THERE FLOWER YOU GIMME GIMME FLOWER FLOWER, then the sign FLOWER was counted as having occurred three times. This way of disregarding immediate

and successive repetitions of a sign in the transcriptions of the chimpanzees' signing was also used by Terrace and the Gardners.[331]

2.3. Semantic categories.

The reliable signs in the vocabularies of the four cross-fostered chimpanzees (Washoe, Moja, Tatu and Dar) were grouped by the Gardners into semantic categories. Their category system was used to group the signs that were found in the recent corpora (with replacement of the syntactic categories of noun and verb by the semantic categories object and action, see 2.1.3.). In Table 4.9. these semantic categories are listed again.

Table 4.9. Semantic categories.

Category	**Examples earlier sign use (Gardners)**
Names for chimpanzees	WASHOE, MOJA, TATU, DAR
Names for humans	ROGER, NAOMI, R.A. GARDNER
Generic names	BOY, FRIEND, GIRL
Person terms	YOU, ME, WE
Objects – animates	BABY, BUTTERFLY, HORSE
Objects – edibles	APPLE, BANANA, COOKIE, GUM
Objects – inanimates	BALL, HAT, SHOE, SPOON, TREE
Objects/Actions	BRUSH, DRINK, FOOD/EAT
Actions	CHASE, CRY, RUN, TICKLE
Locatives	DOWN, IN, OUT, UP
Modifiers – colours	BLACK, GREEN, ORANGE, RED
Modifiers – possessives	MINE, YOURS
Modifiers – materials	GLASS, METAL, WOOD
Modifiers – quantitatives	ONE, TWO
Modifiers – comparatives	BIG, DIFFERENT, SAME, SMALL
Modifiers – qualities	HOT, SOUR, SWEET
Markers and traits	GIMME, HURRY, FUNNY, GOOD

A vocabulary test of the signs that were used in the corpora of recent conversations was not undertaken because of time limitations. Instead, the category system of the Gardners functioned as a first preliminary division of the signs according to their meaning. Further

[331] However, the Gardners (1971) also took out repetitions of a sign with a different sign in between. An utterance such as GIMME FOOD GIMME was transcribed as GIMME FOOD. In the example above, the multiple-sign utterance FLOWER THERE YOU GIMME would result when using the Gardners' rules.

information was then provided by the particular utterances in which the signs were used in the recent corpora, together with the contextual information and the communicative intention codes of these utterances. All of this information combined was then used to attempt an approximation of the most plausible semantic categories of the signs in the four recent corpora.

2.4. Imitation.

In order to analyze how many times the chimpanzees possibly imitated a sign from the human, the following criterion was used. If the chimpanzee produced a sign that had been made by the human companion within the five previous seconds, it was considered an imitated sign. For example, if during a conversation at 1 minute and 10 seconds the human asked WHERE FLOWER? and the chimpanzee answered FLOWER at 1 minute and 12 seconds, then this sign was considered to be an imitation. The five seconds criterion was not only taken into account before a chimpanzee utterance started, but also while the chimpanzee was busy making his or her utterance. This can be explained by another example. It is taken from a session in the *1993* corpus. At 12 minutes, 5 seconds, and 9 tenths of a second Moja started signing GOOD MOJA... She was interrupted by Bodamer who signed RED at 12:06.5. Moja continued her utterance by adding THERE RED MOJA. Represented in another way:

Start:12:05.9 Moja: GOOD MOJA...

(12:06:5 interruption by Bodamer: RED)

...THERE RED MOJA. End at 12:09.1.

The RED in Moja's utterance was considered an imitation.

The criterion of five seconds was taken from earlier studies with the signing chimpanzees, in particular from the imitation study with Nim Chimpsky by O'Sullivan and Yeager (1989) and the two studies by Kennerud (1993; Kennerud, Raymond & Fouts, 1990).

It was considered to be more useful than the criterion that Terrace used with Nim or the Gardners with their chimpanzees. In their publications a sign was considered an imitation if it was a repetition of a sign from the human's immediately prior utterance (Terrace, Petitto, Sanders & Bever, 1979; Gardner, Gardner & Drumm, 1989; Gardner & Gardner 1994). Terrace did not use a time limit here, nor did the Gardners. The immediately prior utterance of a human within human-chimpanzee conversations was usually made within a few tenths of seconds to a few seconds before the chimpanzee utterance. Most immediately prior human utterances were therefore covered by the five seconds criterion. However, in addition, with this criterion all human utterances within the five previous seconds were taken into account, not just the one immediately preceding, but sometimes also two or even three preceding utterances. An example from the *1992* corpus to show this rule is the following. At 1 minute and 35 seconds in the conversation the human signed NUT SANDWICH, ending at 1 minute and 36 seconds. Two seconds later, at 1:38 the human made another utterance: WHAT THAT? The chimpanzee, Tatu, then signed SANDWICH at 1 minute and 41 seconds. Though SANDWICH was not signed in the immediately preceding human utterance, the human had signed SANDWICH in the five seconds before Tatu signed it. Therefore Tatu's SANDWICH was considered an imitation.

In child language studies different criteria for imitation have been used. Bloom, Rocissano, and Hood (1976) had a criterion in which a word was imitated by the child if it had been part of the preceding utterance of the adult. In an earlier study on imitation, Bloom, Hood, and Lightbown (1974) considered an utterance to be imitative if it contained the words of the adult spoken up to five utterances before the child utterance. This latter criterion is closer to the five seconds criterion used in the current study, though the five adult utterances may have taken a still longer time to produce. In the chimpanzee study, however, quite a long time would sometimes be covered if the five utterances criterion would be used. In order to stay closer to recent human utterances the five seconds criterion was chosen. It may happen

that a chimpanzee sometimes imitated a sign that was made by the human in more than five seconds before. This was then not covered by the used criterion. However, it was considered necessary to have a time limit on the period within which signs were made that could have been imitated. Five seconds was thought to be a more plausible timespan than ten or more seconds.[332]

Besides determining how many individual signs were imitated, it was also assessed how many utterances within the total number of utterances made by each individual chimpanzee contained one or more imitated signs. There were three types of possible utterances. In novel utterances none of the signs within the utterance were imitated from the human in the five previous seconds. Two types of utterances containing imitated signs existed: fully imitated utterances and expansions. In a fully imitated utterance all signs had been made by the human in the five seconds before. To give an example, if the human signed YOU PLAY CHASE and the chimpanzee then signed CHASE YOU, all signs in the chimpanzee utterance were imitated. Expanded utterances or expansions contained signs that were made by the human in the five previous seconds, but also novel signs that had not been made by the human. For example, a human signed WHERE BIRD? The chimpanzee then signed FLOWER BIRD GIMME. The BIRD counted as an imitation, but FLOWER and GIMME were considered to be nonimitated.

Note here that it may not always be the case that the chimpanzee was actually imitating in these situations. The human and chimpanzee may simply have been communicating about a topic where both alternately talk about the same object or action. The same signs might then have been used by both species in order to add to the conversation, rather than to imitate each other. However, in order to allow for the calculation of imitation percentages, the mentioned criterion was used. Also, the exact results of this procedure might

[332] Bloom, Hood, and Lightbown (1974) further analyzed the utterances of two children who imitated little. They used a ten utterances boundary to see whether they were imitating a further removed model. The result was that only few utterances existed that could be considered imitative in the interval between five and ten

indicate that the chimpanzee was imitating signs or that the human and chimpanzee were communicating about the same topic. For example, structureless strings of signs with one or two human signs would suggest that these were imitated.

2.5. Utterance boundaries.

The Gardners determined when a chimpanzee utterance began and ended by borrowing from the definitions for utterance boundaries that apply to American Sign Language. In ASL the hands of the signer return to a position of repose at the end of an utterance. Usually the hands then rest on some surface, either the signer's own body or some nearby surface (Stokoe, Casterline & Croneberg, 1965). The Gardners found that usually their cross-fosterlings similarly relaxed their hands when they had finished making an utterance. Their arms and hands then moved out of the signing space (the space in front of the face and upper body) and made contact with some surface to rest upon, manipulated an object, or assumed support of their body (such as touching the ground). The Gardners' coders determined the segmentation of the signing into utterances from these behaviours. They generally had high reliability in establishing the utterance boundaries in this way (Gardner, Gardner & Nichols, 1989; Rimpau, Gardner & Gardner, 1989; Gardner & Gardner, 1994a). Terrace and his colleagues also mentioned the relaxation of the hands as a way to determine whether a sequence of signs was a combination of signs. A sequence was considered a combination in: "the occurrence of two or more different signs that were not interrupted by the occurrence of other behavior or by the return of the hands to a relaxed position" (Terrace, Petitto, Sanders & Bever, 1979, p. 892).

In setting up the segmentation of the chimpanzees' recent signing into utterances, it was found that the signing did not always neatly fit a definition in which an utterance ends when the hands go out of the signing space and then relax. Often the hands were still in the

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intervening adult utterances. This made them feel that it might be implausible to consider these utterances as imitative at all.

signing space and sometimes the hands were even still within the configuration and place of a sign, but the hands were kept motionless. It was considered important to avoid a subjective determination of utterance boundaries by looking at the content and meaning of the signs and the way in which signs were combined. Such a method could result in a segmentation of utterances in which the human observer might project their own linguistic patterns on the chimpanzee signing. Because this study was carried out to determine whether the chimpanzees were in fact combining signs meaningfully at all in these corpora, this was not the proper method. To avoid artificially constructed linguistic combinations of signs, a more external segmentation criterion was decided upon. It concerned the motion of the signing. Though subjectivity was still allowed to play a part in determining the end of an utterance, the main rule was that continuity or fluidity of movement of the chimpanzee's signing meant that an utterance was still continuing. See appendix A for the exact instructions used to determine utterance boundaries.

With continuing movement as the main distinctive feature, it sometimes happened that a chimpanzee utterance was interrupted by the human interlocutor. The chimpanzee could then immediately react to the human, without stopping the movement of his or her signing. An example of this particular phenomenon comes from the *1993* corpus. Moja first signed CLOTHES BRUSH... Mark Bodamer then interrupted by signing CLOTHES. Moja then continued (she had not stopped in between) with ...CLOTHES TOOTHBRUSH THERE... at which point Mark then asked CLOTHES WHO, to which Moja continued with ...CLOTHES MOJA COME MOJA THERE DRINK... Mark then interrupted with CLOTHES WASHOE and Moja finally finished her signing movements with ...UK [unknown sign] THERE. It may have been the case that Moja stopped one utterance and then reacted to Bodamer's interruption with another utterance. Such human interruptions happened every now and then in the *1993* corpus, for example, when a chimpanzee was busy repeating a sign over and over and Bodamer judged that the chimpanzee was done with his or

her utterance and it was his turn to sign. The chimpanzee, still signing an utterance, then saw the human's signing and might immediately respond to it (for example, by adding a name sign to a request utterance), making no stop or pause in the movements of the signing hands while doing so. According to the used definition of utterance boundaries, the whole concatenation was then considered one utterance. This phenomenon of human interruption causing continuous movement may not have been detected by the criteria that were used (unless the observer determined a segmentation by a subjective feel). However, the human interruptions were detectable on the videos. It was therefore easy to find out which utterances may have been influenced by a human interruption. By using the mentioned criterion though, an overattribution of linguistic patterns in the chimpanzee sequences of signs was still ensured.

The boundaries of the chimpanzee utterances in the *1992*, *1993* and *1994* corpora were determined by the author. Wendy Shaw was trained in using the segmentation criteria and then took 20% of each study to enable a reliability measurement. The agreement between Shaw and the author was 93% for the *1992* corpus, 88% for the *1993* corpus and 92% for the *1994* corpus (with an error of plus or minus 1 second).

For the *1999* conversations the transcribers determined the chimpanzee utterance boundaries, as they were identifying the signs. They used the same criteria that had been used for the other three corpora. For 20% of the *1999* sessions the author functioned as the second coder to assess the reliability of the utterance boundaries as established by the transcribers. The percentage of agreement between the author and the transcribers was 95% (again, with an error of plus or minus 1 second).

2.6. Semantic relations.

There are different ways to determine semantic relations. One is by doing a syntactical analysis in which the position of the words or signs indicates the semantic roles of the words

or signs. During the course of this study it was found that there was considerable variation in the order of the chimpanzees' combinations. This method was therefore not considered appropriate.

Another way to determine semantic relations is by way of "rich interpretation," a term coined by Brown, in which different coders subjectively judge the relation by using contextual information. This method was not applied in this study either, because coders might interpret a combination too readily as the expression of one of the semantic relations. The following procedure was therefore used instead. First, two-sign utterances were grouped as candidates for semantic relations according to the scheme of semantic relations that the Gardners used in their 1994a analysis of phrases. Different from the Gardners' method, however, this was an initial division only. Two-sign combinations were thus represented as combination types of the semantic categories to which the two signs of the combination belonged. For example, a combination of a person sign and an object sign (like MOJA and APPLE), became a candidate for the semantic relation Agent+object. A combination of an attribute and an object sign (for example, RED and BALL) was initially assigned to the Attributive relation. Combinations of action signs with object signs (for example, OPEN and BOOK) were considered candidates for the Action+object relation. In Table 4.10 the combination types of semantic categories are grouped according to the semantic relation the Gardners considered these to be the expression of. It is a direct copy of the Gardners' Table 4 of 1994a (*Child scheme of semantic relations applied to chimpanzees*) and is considered useful to represent here, because it shows which particular combination types of semantic categories were considered to be examples of which particular semantic relations. For each combination type a chimpanzee example from the Gardners' table is included.

However, it was not considered sufficient to divide the two-sign combinations into candidates for semantic relations and have no further examination of these utterances. It is important to have some sort of plausible judgment or interpretation of the meaningfulness of

Table 4.10 The Gardners' scheme of semantic relations.

Semantic relation	Chimpanzee combination types with examples	
Nominative	demonstrative+object THAT HAT	demonstrative+object/action THAT DRINK
Agent+Action	person+action ME OPEN	object/action+person TATU DRINK
Object+Action	object+action BALL CATCH	object/action+object EAT APPLE
Locative Action	locative+action TICKLE THERE	locative+object/action DRINK HOME
Object+Locative	locative+object NUT THERE	
Attributive	attribute+object BLACK DOG	attribute+object/action RED TOOTHBRUSH
Possessive	object+MINE,YOURS MINE HAT	obj/action+MINE,YOURS MINE DRINK
Experience/Notice	obj+SEE,SMELL,HEAR FLOWER SMELL	person+SEE,SMELL, HEAR SEE SUSAN
Negative	negative+object NO HAT	object/action+negative BRUSH NO
Requests	object+request MORE BALL	object/action+request GIMME DRINK

Semantic relation	Chimpanzee combination types with examples		
Nominative	demonstrative+person THAT NAOMI		
Agent+Action			
Object+Action	demonstrative+action THAT OPEN		
Locative Action	locative+person ME UP		
Object+Locative			
Attributive	attribute+demonstrative THAT WHITE	person+trait SORRY DAR	
Possessive	demonstr+MINE,YOURS THAT MINE		
Experience/Notice			
Negative	negative+action NO CHASE	locative+negative CAN'T OUT	
Requests	request+action TICKLE MORE	locative+request OUT PLEASE	demonstr+request GIMME THAT

the particular two-sign combinations. There has to be a way by which combinations of signs that are not meaningfully related and that may be an instance of coincidental juxtaposition of signs or some form of routine pattern (such as the "Eve eat" routine mentioned in 3.2.), are sifted out. Remember that in chapter 3.4. a hypothetical example was mentioned of a combination of an object and an action, GUM CHASE. In the Gardners' analysis this sequence would then automatically be assigned to the Object+Action semantic relation. However, it is difficult to imagine that this combination expresses an action that is done with an object (chasing gum), and if one knows that the chimpanzees frequently ask for gum and chase games in 1-sign utterances, it becomes inappropriate to consider this combination to show a semantic relation.

In order not to get inappropriate data by using the Gardners' method of assignment, in this study the following procedure was used. First, the two-sign combinations were grouped as candidates for semantic relations based on the semantic categories of the two respective signs. Then the place of each combination within the corpus was examined: the context, the particular code of communicative intention given to the combination, and other additional information was taken into account, such as what the chimpanzees frequently sign in 1-sign utterances, and the chimpanzees' contingent (previous and later) utterances within the session. In the Results chapter this information will then be provided and an attempt at interpretation of the meaningfulness will be made. This more transparent way of interpretation then allows for anyone to criticize the particular decisions made by the author and provides material for future discussion on the best interpretation. At the same time, it will ensure that probably meaningless combinations such as GUM CHASE will not disappear in automatic analyses such as those of the Gardners, which in their publications cannot be found anymore. In contrast, in this study they will show up and draw attention to themselves.

2.7. Communicative intentions.

The coding of utterances into communicative intentions was done by using the following procedure, based on the methods used in the study of communicative intentions of human children.

2.7.1. Categories of communicative intentions.

Using the category systems from the literature on children's communicative intentions, a system was constructed for the signing chimpanzees. In order not to preclude in advance the presence of certain intentions in the chimpanzee utterances, an attempt was made to be as inclusive as possible with regards to all the categories found in the child studies. In the study of communicative intentions in the communicative and linguistic development of human children there is no one system of categories that all researchers agree upon. Different categories or subcategories are sometimes used, also depending on the age of the children studied (see section 2.4.1.). However, one can discern an overall agreement on certain general categories, such as requesting, naming, asking and answering questions, protesting, calling/greeting, and the expression of emotions and other internal states. By including most of the categories from the child studies, it was hoped to have a system of categories extensive enough to make an exhaustive analysis of the chimpanzees' communicative intentions while using the signs.

One category that was not found in the child category systems of communicative intentions, was Apology/Appeasement. Though one can imagine this to be a part of general child intentions, it has been reported as a common intention in the signing apes (Gardner, Gardner & Van Cantfort, 1989; Patterson, Tanner & Mayer, 1988). It was rather easy to operationalize this intention. The context would be one where the ape is scolded by the human after misbehaving or having done something wrong, and the ape might use signs such as SORRY and GOOD. Because it was easy to operationalize, this intention was added to the coding system.

Where this was possible, it was considered important to have several, more specified subcategories of an intention rather than one big general category. In this way more specific and detailed information about the intentions underlying the use of signs by the chimpanzees can be obtained. Thus, rather than having one big Request category, it was considered valuable to have several subcategories of requests, in which each category specified the particular kind of thing that was requested. This resulted in four different request categories, differentiating between requests for objects, requests for actions, requests for information, and requests for attention. The same was done with the Naming categories. Rather than one overall Naming category, there were, again, four different ones. One for simple Naming or labeling, and three more specific naming categories: one for naming the properties/attributes of an object, event, or situation, another for naming the possession, and yet another for naming the location (of an object, event, or situation).

A category system with 17 different communicative intentions was thus constructed for use in this study. In Table 4.11 these categories are presented together with their definition. The table presented as appendix B of this dissertation provides the operationalization of these intentions and gives some examples from the child literature of each intention.

Notice that there is a degree of overlap between these categories of communicative intentions and the categories of semantic relations presented in Table 4.10. For example, the communicative intention of naming Properties appears to be the same as the Attributive semantic relation. In both attributes of objects or events are described. There is a difference, though, between semantic relations and communicative intentions. This is that the communicative intention can sometimes be different from the semantic meaning of an utterance. The fact that the underlying communicative intention can be different from the meaning expressed in the literal words or signs used in an utterance, has been described by

Table 4.11 Categories of communicative intentions.

Communicative Intention	Definition
Naming/Labeling	The chimpanzee labels, identifies, or names an observable object, event, person, action, or situation.
Properties	The chimpanzee labels perceivable attributes of objects or events, such as colour, shape, or movement.
Possessions	The chimpanzee indicates who owns or temporarily possesses an object.
Locations	The chimpanzee indicates the location or direction of an object, event, etc.
Request for Object	The chimpanzee solicits the human companion to provide an object which is usually out of reach for the chimpanzee.
Request for Action	The chimpanzee solicits the human companion to act upon some object or to carry out some other action.
Request for Information	The chimpanzee solicits the human companion to provide information about an object, action, location, etc.
Calling/Request for attention	The chimpanzee makes contact with the human by soliciting attention.
Protesting	The chimpanzee objects to or expresses disapproval of the human's action or utterance.
Apology/Appeasement	The chimpanzee apologizes for misbehaviour or appeases human.
Internal reports	The chimpanzee expresses an internal state (emotions, sensations, etc.), capacities, or intents to perform an act.
Attributions	The chimpanzee expresses beliefs about another's internal state, capacity, intent, etc.
Evaluations	The chimpanzee expresses impressions, attitudes, or judgments about objects, events, or situations.
Explanations	The chimpanzee reports reasons, causes, and motives for acts, or predicts future states of affairs.
Markings	The chimpanzee marks a variety of events.
Answering	The chimpanzee responds to a question or request for information from the human with the semantically appropriate data.
Unclear	The intention is unclear and the contextual information is not enough to classify it into one of the categories of intentions.

Dore (1975b) as the difference between the referential and the intentional meaning of an utterance. Searle (1969) made a distinction between the proposition and the illocutionary force of a speech act (see also section 2.4.1., especially footnote 139). Because the goal of this study was to acquire more information on both semantic relations as well as communicative intentions, both category systems were used. Despite the overlap in categories, this allowed for exactly such information to show up in the analyses: communicative intentions that differ from the utterances' expressed semantic relations.

2.7.2. Operationalization and determination of communicative intentions.

Communicative intentions cannot be directly observed. They can only be inferred from the context and the information within the utterance. An element of subjectivity can thus be involved in determining the communicative intention at hand. However, from the start of this field of research, the investigators studying communicative intentions came up with five important aspects of an utterance that are more objective indicators of the intentions and operationalize the definitions of each intention. These five aspects will now be presented.

1. *The semantic content of the utterance.*

The meaning of the words or signs in an utterance can specify by itself which particular intention is expressed. For example, the presence of request markers, such as GIMME or MORE, indicates a request and does not suggest a simple naming/labeling of an object. Internal state terms such as FEEL or HURT are used to express internal states and point to the intentions Internal reports or Attributions. Similarly, the presence of colour words or signs in the utterance might show the intention of naming Properties. Possessives such as MINE and YOURS indicate naming Possessions. Locatives such as IN, UP, and THERE suggest naming Locations to be the case. Saying "stop!" or signing NO can indicate Protesting.

2. *The grammatical and prosodic aspects of a spoken utterance, or the grammatical and inflectional aspects of a signed utterance.*

Grammatical and inflectional devices can additionally point to the intention that underlies the utterance. Modifications of pitch, loudness, tempo, and rhythm can indicate differences in intention. Repetition, for example, can be used to add emphasis to one's utterance, and can be helpful in uttering a request. Inflecting signs into the question form suggests a Request for Information.

3. *The accompanying nonverbal behaviour of the speaker/signer.*

This includes gestures, vocalizations and facial expressions. For example, awaiting a response from the interlocutor by prolonged looking at the conversation partner, may indicate that one is requesting something. Reaching, leaning, and stretching a hand towards an object can then be indicative of a request for an object. The absence of these three behaviours, but a presence of playful facial expressions, may then suggest a request for action. Showing an object and not awaiting a response from the interlocutor (by not looking prolongedly) may be indicative of naming.

4. *The context.*

Included here is the particular behaviour context as well as the social and physical situation: activities, topic of conversation, games events, objects and persons present and/or attended to. For example, the presence of objects or picturebooks may be indicative of naming intentions. The absence of objects and a context of playful interaction may accompany a request for action.

5. *The behaviour of the conversation partner.*

This includes the conversation partner's contingent spoken or signed utterances and accompanying nonverbal behaviour. For example, when the human engages in some form of action or play after the utterance by the chimpanzee, a request for action may have been the case. When the human responds by giving an object, or by refusing to give one by signing (utterances with) CAN'T, SORRY or LATER, the chimpanzee may have requested an object. Not only the human behaviour after the utterance is of relevance here, but also the human's behaviour during and before the utterance. For example, a human may have been naming pictures in a picturebook, then point to a picture and ask the chimpanzee WHAT THAT? The chimpanzee may then react by naming the picture. To this the human can then respond by signing YES or NO, indicating the correctness of the chimpanzee's naming. The human

orienting towards the chimpanzee after the chimpanzee's utterance while not attending to the chimpanzee before is suggestive of Calling/Request for Attention.

These five contextual and behavioural aspects accompanying an utterance combined can indicate what communicative intention is the motive for uttering a particular utterance. However, not every utterance is accompanied by enough information in all five aspects to ensure an unambiguous judgment of its communicative intention. So again, a subjective judgment, based on the feeling the judge has, combined with general knowledge of the (chimpanzee and human) interlocutors and their past history, is sometimes inescapable. However, the more information that these five aspects carry the less subjective the assignment of the utterance to one of the intentions can be.

A table was made specifying the different communicative intentions together with the five contextual aspects that indicate each specific intention. It is presented as Appendix B of this dissertation. The definition for each intention was given and in different columns information was presented regarding the following aspects indicative of the intention: signs of the chimpanzee utterance; chimpanzee behaviour; context; human behaviour; examples from the child literature; examples of chimpanzee utterances (where this was possible); and a column with further important notes to keep in mind.

The table should be seen as a presentation of the operational definition for each intention. It was possible to operationalize most intentions in this way, except for Internal reports, Attributions, Evaluations, and Explanations. It was not easy to come up with behaviours that indicated these four categories. Instead it is the semantic information within the utterance, as well as the particular context, that indicate whether these particular intentions are the case.

An additional rule was set up for the Answering intention, which stated that this category could only be chosen after having tried to fit the utterance in any of the other intentions. Only when this was not possible, and it was still a transmission of information,

was one allowed to code it as Answering. This specification was done in order to increase the information that would be obtained from the coding. Many utterances of the chimpanzees followed a question from the human interlocutor. Coding every reaction to a question as Answering would then result in a large, but further uninformative category.

2.7.3. Coding and reliability.

The author coded all chimpanzee utterances for communicative intention. This was done by using coding sheets. On a coding sheet the author first filled in the signs of the chimpanzee utterance and the time (in seconds) when the utterance began and ended on the videotape. Then, for each utterance it was marked which of the accompanying behavioural and contextual aspects from the operational definitions of the communicative intentions were present. Thus, the different chimpanzee behaviours that were present were marked, what context was the case, and what particular human behaviours accompanied the utterance. A criterion of five seconds before or after the utterance itself was used for these aspects, depending on whether the behaviour should take place before or after the utterance. Also, the human previous utterance within the five seconds before the chimpanzee utterance was noted. A space for further comments was left open to describe behaviours that might have occurred in a period longer than five seconds before or after the utterance, or to make notes on the behaviour of other chimpanzees present. An example of a coding sheet is presented in Appendix C.

After filling in the whole sheet, the author judged what communicative intention appeared to fit best with the situation. The guidance that the author could make use of in the coding process was manifold. It consisted of the information from the videotaped conversation, which could be replayed as many times as desired. Use was also made of alternately playing the segment in slow motion and real time. Further guidance came from the structured information on the coding sheet in relation to the table of communicative intentions. Other sources were the author's knowledge of the research literature on children's

communicative intentions, as well as his personal experience with the five chimpanzees of the CHCI. Over a period of 6 years the author had made four visits to the institute, covering a period of 21.5 months. Though his focus had been on setting up and carrying out research, the author had assisted in the normal chores to take care of the chimpanzees and had gained familiarity in this way with the five chimpanzees and their behaviour.

In order to assess the reliability of the author's codings Ph.D. student Mary Radeke was trained in coding the intentions (see 4.2.1.2. in this chapter for her chimpanzee and ASL experience). Radeke was familiarized with the concept of communicative intentions by giving her literature on the research with children to read and study. The table was discussed, as well as a particular form with instructions on coding the intentions. Several conversation sessions between the chimpanzees and humans were then used for training. They were looked at by Radeke and the author together. In discussing these sessions and the communicative intention codings of the particular utterances in them, a few additional rules were created to ensure clarity of coding. These were the following:

- Note concerning expanded utterances: If the utterance is an expansion, consisting of a combination of one or more signs just made by the human interlocutor plus new signs, do not use the semantic information of the signs that were just made by the human, as those signs may have been imitated. So, for example, if the human just signed YOU GOOD, and the chimpanzee's utterance follows within 5 seconds (the criterion for imitation) and consists of GOOD GIMME: Only base your judgment on GIMME and do not involve the GOOD sign in assigning the utterance to a category.

- The chimpanzees and humans play games with objects together. Because of the chimpanzees' captive situation the bars and caging between the chimpanzees and the humans sometimes make it impossible to give an object to the chimpanzees. So sometimes games are played in which the human plays with the object, moves it about and such, and the chimpanzee watches and behaves playfully. In some of these games, the game is all about touching an object (or a human's bodypart, like a foot or shoe) briefly and then both chimpanzee and human are all excited and move about playfully. Loulis does this for example. During such games Loulis may

sometimes sign THAT while pointing to an object that the human is playing with. This does not have to mean that Loulis wants to physically obtain the object, but may rather mean that he is asking for the game routine of touching the object briefly. So rather than asking for the object, the THAT sign can mean asking the human to put the object against the caging so he can touch it and the game can be played. So, when the chimpanzee and human are in a context of mutual play, and the chimpanzee has been requesting playful action before, utterances with THAT may also be Request for Action, if the resulting action is that the human puts the object against the caging so the "briefly-touch-object-and-then-move-playfully-about" game can be played.

- The use of action signs such as HUG and COME may not always refer to a request for action. The chimpanzees sometimes use these signs in clear requests for objects, such as GIMME FLOWER GIMME FLOWER FRUIT FLOWER HUG COME, or FLOWER COME FLOWER HUG. Also, Washoe has been observed to use HUG to get food and other objects from the chimpanzees. If action signs such as HUG and COME are part of request utterances or interspersed by other clear Request for Object utterances, then most likely the action signs are used to add emphasis to a Request for Object, rather than that they refer to a Request for Action (in other words, HUG and COME sometimes also function as request markers).

- Utterances consisting of only the sign GIMME are Requests (and more probably RQO than RQA, because of the semantic information "give me").

- Utterances consisting of a combination of signs with GIMME as the last sign are more likely to be Requests. In general, when there is a combination of object sign(s) and request markers: Request for Object takes precedence over Naming. It may be part of a double-code as in NAM/RQO, but do not use this too quickly, because the other signs may have been added not to name something, but maybe more as a response to the human's utterance. Just be careful in giving that a double code. To explain this rule here: In a Kennerud session, Washoe signs ROGER HURRY GIMME. The double-code NAM/RQO would not be right here, since ROGER was used by the human interlocutor in the 5 seconds before (THAT ROGER THAT) and should therefore not be used in the judgment.

Radeke separately coded six conversation sessions as a try-out. The agreement with the author was 89%. This included agreements where one had the same intention as part of a double-code, as when one had a doublecode of Request for Object/Request for Action, and the other had a single code, such as Request for Object only. Radeke was then given 20% of all utterances of each of the four corpora to code on communicative intention. The particular utterances chosen for her to code were randomly selected. It was ensured, however, that she was given utterances of each participating chimpanzee in each corpus, in the same percentage as the chimpanzee had participated in the corpus. This meant that, for example, when Moja's utterances in a corpus took up 24% of the total, the utterances of that corpus given to Radeke for reliability were also for 24% Moja's. Radeke was given filled in coding sheets except for the communicative intention. She could replay the videotaped segment as much as she wanted and was allowed to draw on her experience with the signing chimpanzees. An agreement was obtained on communicative intentions between Radeke and the author of 84% in the *1992* corpus, 92% in the *1993* corpus, 87% in the *1994* corpus, and 91% in the *1999* corpus.

2.7.4. Unprompted utterances and communicative intentions.

As was noted in chapter 3.3., the humans in the ape sign projects often asked the chimpanzee subjects (routine) questions that they should answer, and prompted the chimpanzees in other ways to make signs. The communicative intentions of unprompted utterances might therefore show more clearly what the chimpanzees want to use the signs for out of their own accord. In her study of Ally's communicative intentions (see its description in 2.4.2.), Miles (1976) made a distinction between solicited and unsolicited utterances. Solicited utterances followed a Wh-question from the human. Miles argued that these human questions inflated the number of requests for actions and naming utterances, as these were the most appropriate responses to such questions. She then separately analyzed the unsolicited utterances, in order to have data

on what Ally himself wanted to express with his signing. She found that Ally produced many more "other" acts in unsolicited utterances, suggesting that "Ally's solicited responses are not really characteristic of his natural use of signs and should be considered an artifact of the method" (p. 594). She quoted Roger Brown who stated in 1973 that a similar phenomenon of inflation occurred in child language studies "when over-anxious adults distort the conversational setting through determined efforts to elicit communications by asking names of things and producing strings in the respondent, rather than interacting in a natural way."

In order to have some information on utterances that were made more motivationally spontaneously by the chimpanzees, it was decided to make a further analysis of the 2,839 utterances. The unprompted utterances were determined. For the operationalization of unprompted utterances the same time criterion was used that had been applied to determine the spontaneous or imitated nature of the signs. Thus, an utterance by the chimpanzee that occurred within five seconds after some form of human prompt was considered a prompted utterance, no matter what the exact form of human prompting was. As human prompts it was considered important to look beyond Wh-questions only. This resulted in four categories of human prompting that might occur in the five seconds before a chimpanzee utterance:

- Questions: These could be any human questions, Wh-questions and others.
- Non-question utterances: This category included any human utterance that was not a question. The human utterance could be a comment or remark on some object or picture, but may also have been directed at the chimpanzee him- or herself.
- Points: The human points to an object, a picture, or a location, or holds up an object or picture to show it to the chimpanzee.
- Object manipulations: The human manipulates an object, such as playing with it. Simple holding of an object was not considered part of this category.

All human utterances were thus considered to be a prompt. Obviously not all utterances that the humans make are produced with the intent to make the chimpanzees sign. However,

sometimes they may function in exactly this way. Similarly with object manipulations: sometimes an object is manipulated to elicit signing from the chimpanzee. Again, this is not always the human intention. He or she may have been "innocently" playing with it. However, in order to rule out any chimpanzee utterance that might have been prompted, it was decided to leave out all utterances following a human utterance or object manipulation.

CHAPTER 4

STUDY OF THE RECENT SIGN USE OF FIVE SIGNING CHIMPANZEES

3. RESULTS

In this chapter the results of the analyses of the signing behaviour by the chimpanzees in the four corpora are presented. Each section on the specific aspects of the chimpanzees' sign use will contain a conclusion of the main findings. Two intermediate summaries in this chapter will list the major results that have been presented. At the end of this chapter all main results will be summarized.

1. Total of utterances.

The four corpora combined provided a total of 3,448 signed chimpanzee utterances that could be used for analysis. Of these utterances 609 consisted of signs that had been imitated from the humans' signs. The remaining 2,839 were utterances that were not fully imitated. In Table 4.12 the total number of nonimitated utterances per corpus are presented, together with the individual chimpanzees' totals per corpus.

Table 4.12. Total number of utterances per chimpanzee per corpus.

Corpus	Total nr of utterances	Washoe	Moja	Tatu	Dar	Loulis
1992	213	59	44	37	8	65
1993	1,197	249	286	379	283	---
1994	1,024	232	267	337	188	---
1999	405	72	134	146	28	25
Total	2,839	612	731	899	507	90

These totals enable an assessment of the chimpanzees' recent sign use in the four corpora from the period 1992-1999. Notice that the total of utterances for Loulis is considerably lower than that of the other four chimpanzees. When one looks at the *1992* and *1999* corpora,

though, Loulis' number of utterances is comparable to that of the other chimpanzees. His overall lower total may be a consequence of his absence in the Bodamer and 1994 studies.

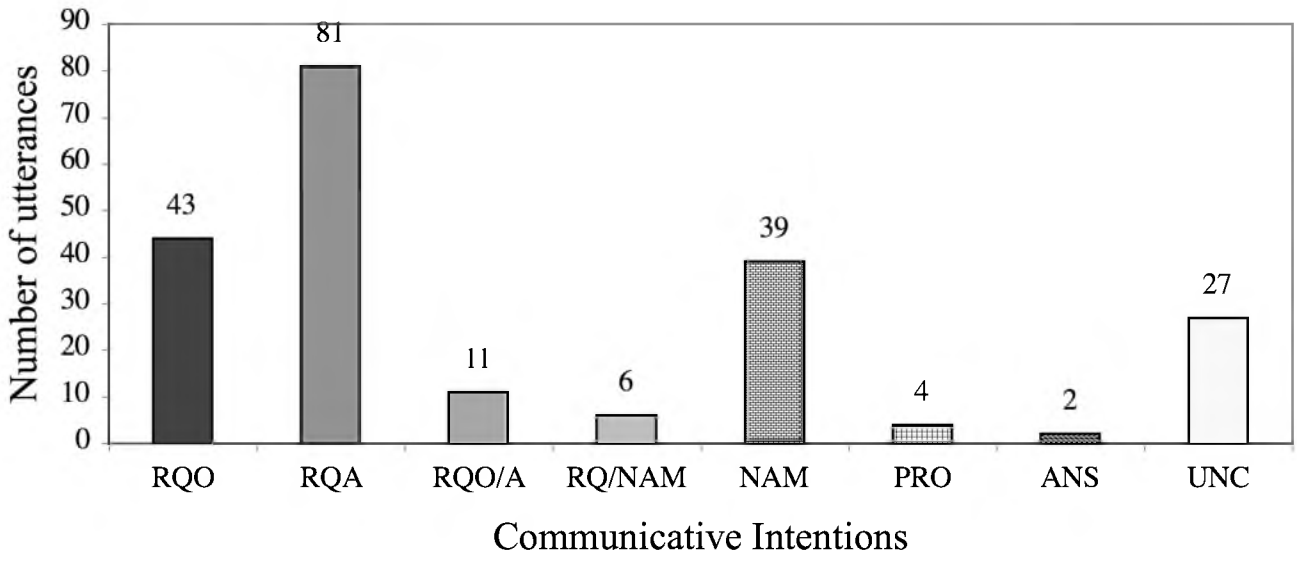
2. COMMUNICATIVE INTENTIONS.

2.1. Results.

In the presentation of the analyses of these 2,839 utterances the communicative intention results will be given first. This is because the data on communicative intentions are relevant to understand the interpretation of the other aspects of the chimpanzees' sign use, such as the individual signs and the combinations (to be presented in the following sections).

2.1.1. ***1992.*** In Figure 4.3. the 1992 utterances are divided over the different categories of communicative intentions they were coded to be an instance of.

Figure 4.3. Communicative intentions of the 1992 corpus



The abbreviations in the graph stand for the following intentions: RQO = Request for Object; RQA = Request for Action; RQO/A = Request for Object or Request for Action (doublecode); NAM = Naming; RQ/NAM = Request (for object or action) or Naming (doublecode); PRO = Properties; ANS = Answering; and UNC = Unclear.

Of the total of utterances 135 utterances or 63% were coded as requests. Requests for action were made in 81 utterances or 38% of the total. Most of these, 65, were made by Loulis. They were all the utterances he made in this corpus, consisting of many THATs and THAT CHASEs in which he requested the human to engage in playful action (see Figure 4.4.) with objects, or to play the game where the human puts her feet to the caging and Loulis briefly touches them, after which the human and Loulis move about playfully.

Figure 4.4. Loulis in the process of signing CHASE to request a chase game.
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The other chimpanzees also requested action from the human (except Tatu, who did not have utterances in this category). Moja in particular asked for action by signing BRUSH THAT for the human to brush her or by signing SMELL and SMELL THAT to smell an object the human was holding. The request markers HURRY and GIMME were sometimes part of the utterances in this category.

Requests for objects occurred in 43 utterances or 20% of the total. The chimpanzees used signs for edibles in this category, such as DRINK, CHEESE, MEAT, FOOD/EAT, MILK, or NUT, or for objects the human was holding by signing GIMME or THAT. Washoe frequently used the sign GIMME in these utterances, either singly or in combinations such as DRINK GIMME or GIMME DRINK GIMME. She and Moja also used the request marker HURRY here. Again, either singly or in combinations such as DRINK HOT HURRY DRINK or in Moja's (interrupted) 12-sign utterance: [GOOD] YOU RED THAT SHOE HURRY DRINK HURRY THAT DRINK BIRD THAT. The sign THAT also figured in these request utterances, when the chimpanzees pointed to an object they appeared to want to obtain. Lastly, 11 utterances or 5% were doublecoded as request for object or action. Most of these were 1-sign THAT utterances, which made them unclear as to whether the chimpanzee wanted an object or a particular action.

Naming, producing signs to name or label objects and pictures, was the case in 39 utterances or 18% of the total. The chimpanzees used the following signs in these Naming utterances: BIRD, DRINK, SODAPOP, SWEET, FLOWER, CARROT, LIPSTICK, COFFEE, CRACKER, NUT, CAT, CHEESE, HAT, CORN and ICE/COLD. It was impossible, though, to determine from the available data whether the chimpanzees were naming correctly. Interesting were eight utterances by Washoe and Moja in which they used the sign BIRD to name a picture or object. An additional four utterances or 2% of the total were considered naming Properties. These were made by Tatu and consisted of 3x BLACK and 1x RED, apparently to describe the colours of objects. These two naming categories bring the total of naming utterances on 43 utterances or 20% of the total. In six utterances or 3% of the total a doublecode was given in the form of Naming/Request for object or action. In these utterances the chimpanzees used object or action signs, such as CARROT and BRUSH. Their context allowed for either naming an object or requesting an object or action.

Two utterances or 1% of the total were coded as Answering. They consisted solely of answering to the human's questions (recall here that many utterances of the chimpanzees followed a human question, but these could only be assigned to the Answering category if they could not be interpreted as another intention, see section 4.2.7.2.). They are interesting to describe in detail. One utterance was by Moja: DRINK BIRD. It occurred in an interaction in which the human had been playing with a coloured ball and naming the different colours of the ball. Moja then signed SMELL THAT. The human then asked Moja WHAT SMELL... WHERE? To this question Moja signed DRINK BIRD in response. After this Answering utterance the human brought out a sodapop bottle and asked THAT SMELL THAT? (while pointing to the bottle). Moja responded with SMELL THAT SMELL. The human then took off the cap of the bottle and let Moja smell the bottle. Twice before in the same conversation Moja had used the sign BIRD in a context where no birds, bird toys, or pictures of birds were present. The other Answering utterance was made by Washoe. In this situation the human had taken out a small mirror, asked WHO THAT? while pointing to the mirror, and then held it up close to Washoe's face. Washoe responded by signing BIRD. The human disagreed and later signed that it was her (THAT YOU). Note that the category of Answering does not imply that the instances were sensible responses to questions.

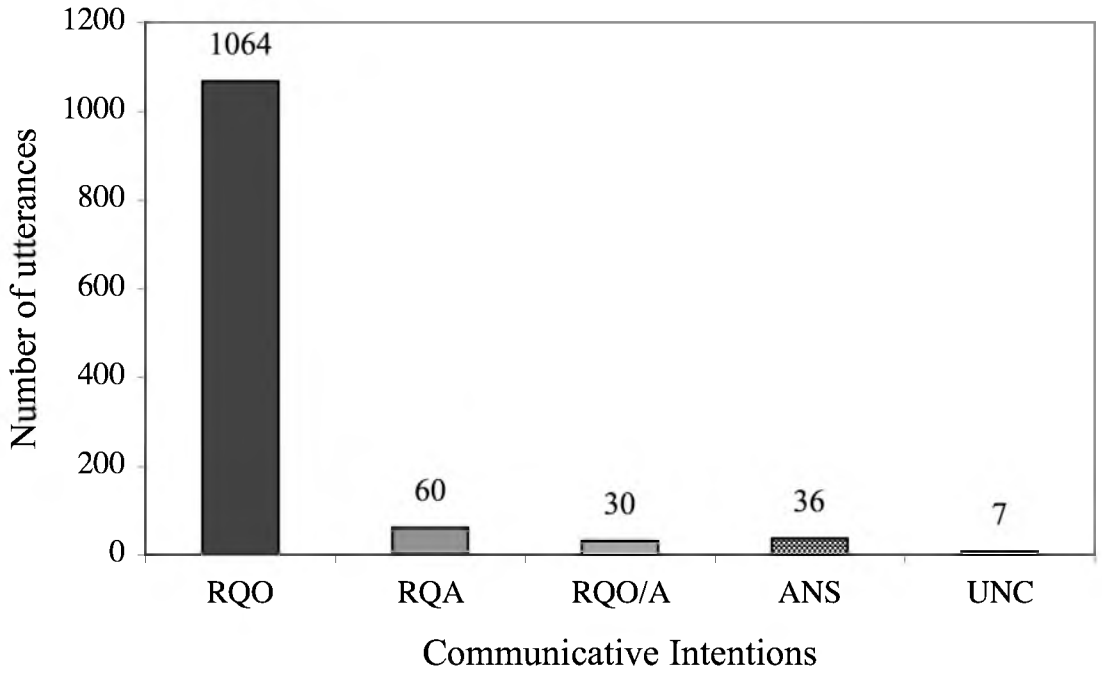
To conclude the description of the communicative intentions in the *1992* corpus, 27 utterances or 13% of the total were deemed Unclear, meaning no clear intention could be assigned to it on the basis of the available information. The utterances assigned to this category were mostly 1-sign utterances of signs for edibles or inanimate objects, such as DRINK and FLOWER. The context, though, did not clearly suggest a request nor a naming intention. Half of Washoe's unclear utterances were made in one session. Nine of her ten utterances there were coded Unclear. They contained four 1-sign BIRD utterances and two DRINK BIRD combinations. Most of these were made while the human was looking at and naming the pictures of a picturebook. The BIRD utterances appeared as if they were some

sort of obligatory signing when the human pointed at a new picture as if to ask Washoe to name it.

Individual differences were present in the kinds and frequencies of the communicative intentions among the five chimpanzees. As was mentioned already, all of Loulis' utterances were requests for action. Of Dar's eight utterances, seven were requests, thus 87.5 % of his total of utterances. Washoe and Moja had somewhat similar percentages to each other: Slightly more than half of their utterances were requests (56% for Washoe, 52% for Moja), and naming utterances were made in 14% of Washoe's utterances, and 23% of Moja's (Dar's one naming utterance accounted for a naming percentage of 13). Tatu had a reversed pattern: 68% of her utterances were naming, whereas only 19% were requests. Dar and Loulis had no unclear utterances, but Washoe's were unclear for 27%, and Moja's and Tatu's for 14%.

2.1.2. ***1993.*** Figure 4.5. presents the number of utterances for the communicative intentions coded for the 1993 corpus.

Figure 4.5. Communicative intentions of the 1993 corpus



The *1993* corpus stands out because the chimpanzee utterances were almost all requests. All the requests combined took up the number of 1,154 utterances, which was 96% of all utterances. The requests made were largely requests for objects: 1,064 utterances or 89% of the total. The chimpanzees frequently used the following object signs in these request utterances: DRINK, GUM, COFFEE (a treat often present in the building), TOOTHBRUSHes with some toothpaste on them to eat, FLOWERs referring to plants to eat, NUT, CHEESE, MEAT, and WATER. Moja frequently asked for CLOTHES in this category, which has been considered to be one of her favourite objects (she has been reported to be the chimpanzee who puts on clothes the most). Other signs used in object requests were the request markers GIMME, HURRY, and the sign THAT, which consists of the chimpanzee pointing (to the requested object). These three signs also occurred in the other three corpora as (part of) requests.

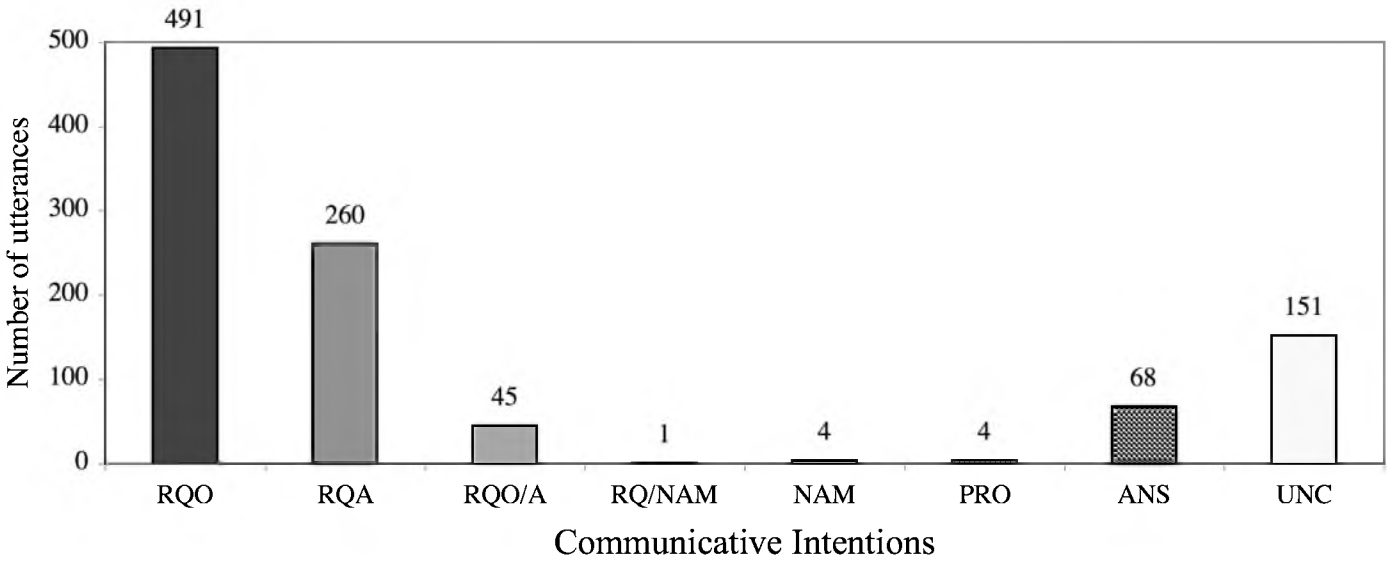
Only 5% of the total or 60 utterances were requests for action. They were made mostly by Moja and Dar. Both asked for BRUSHing. Dar also asked for CHASE. A further 30 utterances or 3% of the total were double coded as possibly a request for an object or an action.

The only other intention besides requests in the *1993* corpus was the Answering category: 36 utterances or 3% of the total. They usually consisted of the chimpanzees giving only their own name sign when the human had asked them a Wh-question. Normally the human had asked WHO, but in five instances it occurred after WHAT, another five after WHERE, and yet another one after WHICH. All of these utterances were made later in the conversation and always after the chimpanzee had uttered one or more requests, such as DRINK, to which the human then typically reacted by asking the chimpanzee WHO DRINK? The chimpanzee then only used his or her own name sign and responded in an Answering way by simply signing TATU, DRINK TATU, and other variations. Only seven utterances in the *1993* corpus were coded Unclear in terms of intention.

All five chimpanzees were similar in their intentions in the *1993* corpus. They all followed the combined totals just presented. The main, though small, differences between the chimpanzees were that Washoe practically only made requests for objects (97% of her total) and that Dar had a greater percentage for action requests (13%) than the combined total.

2.1.3. *1994.* In Figure 4.6. the communicative intentions for the 1994 corpus are given, with the number of utterances for each coded intention.

Figure 4.6. Communicative intentions of the 1994 corpus



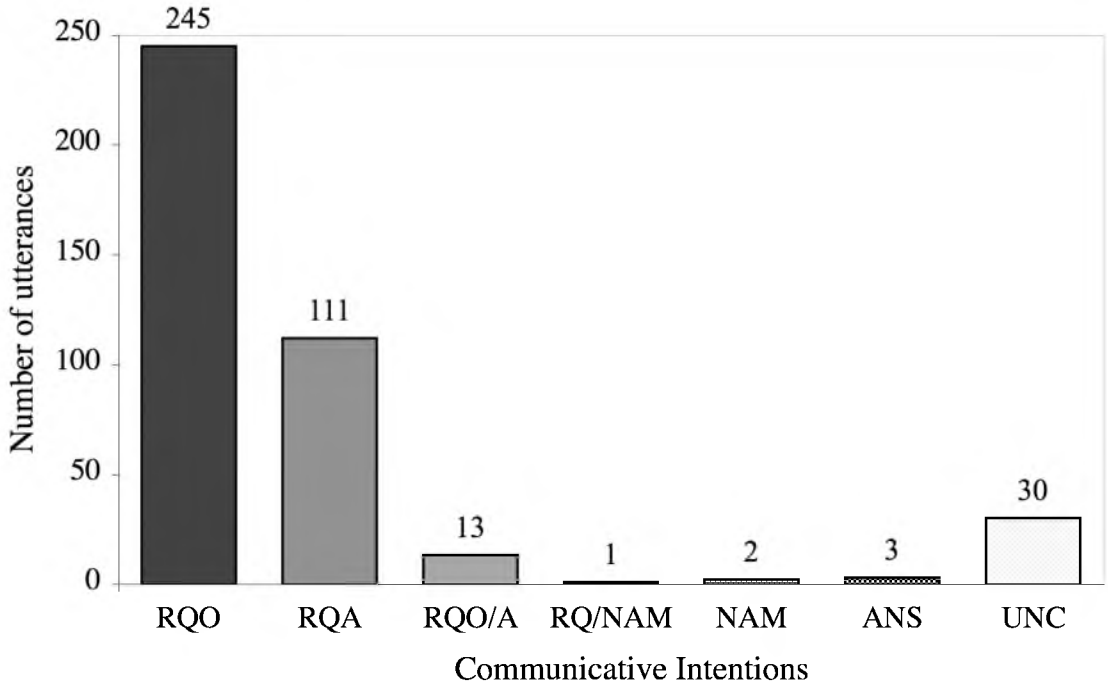
Request codes were given to 796 utterances or 78% of the total. Of these, 491 utterances or 48% of the total were requests for objects. In these utterances the chimpanzees frequently used the following object signs: FLOWERs (from the berm), FOOD and DRINK, TOOTHBRUSHes, and GUM. Other frequent signs for edibles in these requests were APPLE, BANANA, CHEESE, and MEAT. Signs for inanimates were also part of requests for objects. Especially CLOTHES and SHOE occurred often. Requests for action were made in 260 utterances or 25% of the total. Here the chimpanzees (mainly Tatu and Moja) asked Jensvold to blow her breath to them by signing SMELL or SMELL YOU. Further action requests were for BRUSH and CHASE. Moja also asked for PEEKABOO. This was a game in which the humans put their hand(s) in front of their own eyes. It was another common

routine in the CHCI laboratory. A double code of request for object or for action was given to 45 utterances or 4% of the total. Some of these were sloppy FLOWER/SMELLs where it was difficult to determine whether the chimpanzee requested a FLOWER to eat or SMELL to have the human blow her breath.

Only nine utterances (all by Tatu) or 1% of the total were assigned to the naming intentions. Naming itself consisted of four utterances, another four were coded as naming Properties (2x RED and 2x THAT BLACK), and one utterance (APPLE) was double coded as Naming or Request for object. The Answering intention was coded in 68 utterances or 7% of the total. Like in the *1993* corpus, these mainly consisted of the chimpanzee giving his or her own name sign, most of them following a Wh-question from the human. The name sign was sometimes in combination with an earlier requested item, as in TATU SMELL and FLOWER DAR. Finally, 151 utterances or 15% of the total were considered to be Unclear. The majority of these utterances consisted of Tatu using the sign BLACK in a way that has been reported to be a habit of hers. However, the context provided the coders with no further information to assess her intention here.

2.1.4. *1999*. Figure 4.7. presents the number of utterances of the *1999* corpus for each coded communicative intention category. Similar to the *1993* corpus, in the *1999* conversations requests were the underlying communicative intentions for the great majority of the sign utterances. The percentage accounting for requests was large: 91% (369 utterances). Requests for objects were made in 245 utterances or 61% of the total. They contained signs such as TOOTHBRUSH, DRINK, FOOD, CRACKER (for monkey chow at mealtimes), and FLOWER (for plants from the berm). Action requests were part in 111 utterances or 27% of the total. The chimpanzees asked for human actions such as CHASE, BRUSHing, GROOMing and the SMELL interaction. Moja and Dar also asked for the PEEKABOO game. In a few instances Washoe and Moja requested the human to show their

Figure 4.7. Communicative intentions of the 1999 corpus



shoes by signing SHOE. These were coded as action requests, rather than requests for objects. This was because the humans could not give the shoes through the caging, so the chimpanzees could not physically obtain the shoes. Instead, the humans showed their shoes, pushed them closer to the chimpanzee for them to see, or manipulated the shoes, making the SHOE utterances more appropriate as requests for human action. Moja, who made most action requests in the *1999* corpus, also used the sign for SEE/GLASSES in this category. In most instances it was a request for the human to blow on their (sun)glasses, a routine in which she appeared to have an interest. A few times she also used SEE/GLASSES to request the human to show her some part of their body or some object. Moja also signed HAIR several times, for the humans to show and play with their hair. Several times Tatu requested a routine in the action category in which she asked the human to put on and play with a mask by signing MASK. Tatu also asked for the human to put lipstick on Tatu's mouth by using the sign LIPSTICK. Thirteen further utterances were given the double-code Request for object or action, as both could be possible in these instances.

Thirty utterances or 7% of the total were considered to be too Unclear to determine the communicative intention. Of these, 29 were, again, Tatu's BLACK utterances. Her use of BLACK is a clear pattern, not in terms of interpretability, but in the sense that it is a constant, recurring phenomenon throughout the recent years.

Only three utterances, two by Tatu and one by Moja, were considered to be of the Answering category. In two of these the chimpanzees produced their own name sign in response to a WHO question by the human.

Naming was the last category present in the *1999* corpus. There were only two instances, however. One was by Washoe and another by Tatu. Both were prompted by the human to give the name of an object. In the Washoe instance, the human pointed to her food bowl before giving it and asked WHAT THAT? After the human had repeated this question four times, Washoe finally responded by signing FRUIT. Her naming apparently was incorrect, because the human reacted by considering her response to be wrong, signing NO. In Tatu's case the human held up a flower in front of her face to which Tatu reacted by signing FLOWER. Finally, one utterance by Moja was double-coded as NAM/RQO, because her utterance, BERRY, could be interpreted as naming an object or as a request for fruit growing on the berm.

2.2. Conclusion on communicative intentions.

The predominant communicative intention of the chimpanzees' signed utterances is to make requests for objects and actions. The combined total of requests in the four corpora taken together is 2,454 utterances, or 86% of all utterances. The range of requests goes from 63% in the *1992* corpus, to a particularly high percentage of 96 in the *1993* corpus. The following signs are part of request for object utterances: signs for edibles such as FLOWER (for edible plants), GUM, COFFEE, CHEESE, and NUT; the signs DRINK and FOOD/EAT; signs for inanimate objects such as TOOTHBRUSH (for toothbrushes with edible toothpaste), SHOE,

CLOTHES, and MASK; request markers such as GIMME and HURRY, and the sign THAT. Signs that are part of request for action utterances are BRUSH, SMELL (used especially to ask the humans to blow their breath to the chimpanzee), CHASE, PEEKABOO, and again the request markers HURRY and GIMME, and the sign THAT.

Naming or labeling of objects and pictures also takes place but to a considerably lesser extent. The combined total of naming instances is 53 or only 2% of all utterances. It mainly occurs in the *1992* corpus (20%). In the *1999* corpus there are only two instances and in the *1993* corpus it does not even take place at all. Naming occurred particularly as a reaction to the human asking the chimpanzee to identify an object or picture. In these situations, the human usually goes to the chimpanzees with objects and pictures and initiates a naming session (which does not happen that often in these conversations). Most of the chimpanzee utterances in response to the human request for naming consist of one or more object signs. Several other utterances contain a colour sign, which have then been coded as naming the Properties of a certain object. However, with none of the naming utterances a determination is possible as for the correctness or appropriateness of their contents.

The only other category of intention, present in each of the four corpora, is the Answering category. Usually this is in the form of the chimpanzees giving only their own name sign following Wh-questions from the humans, and usually after the chimpanzees has made several requests. The combined total of this intention in all of the corpora is 109 utterances or 4 % of the total.

Besides these three intentions, there are only Unclear utterances: a total of 215 or 8% of all utterances. More than half of these consist of Tatu making an utterance with the sign BLACK. The communicative intention expressed in those utterances is not clear.

2.3. Unprompted utterances and their communicative intentions.

In order to have some information on the communicative intentions of the chimpanzees when they are not prompted by the humans, the unprompted utterances were set apart. An utterance was considered unprompted by the human if it did not follow a human question, utterance, point or object manipulation within five seconds. These are similar to the non-adjacent, also called spontaneous, utterances that the Gardners and Terrace determined when they were looking at imitation (see chapter 2.3.).

A total of 522 unprompted utterances were found. This was 18.4% of the total number of utterances of 2,839. In the *1992* corpus only 11 utterances were unprompted. This was 5.2% of the total number of utterances in this corpus. Analyzed for communicative intention, nine were request utterances, and the two remaining were coded as Unclear. The *1993* corpus had considerably more unprompted utterances: 355 or 29.7% of the total. Most of these resulted from the specific design of the study. At the start of each conversation, the human had his back to the chimpanzee. It was therefore the chimpanzee who initiated the interaction. All 355 utterances were requests, a majority of 93.8% of these being requests for objects. In the *1994* corpus 112 utterances were considered to be unprompted. This is 10.9% of the total in that corpus. Of these 112 utterances 79.5% were request utterances. Requests for objects took up 55% of the request utterances, and requests for actions 42%. Then there were 21 Unclear utterances, in a percentage of 18.8% of the total of unprompted utterances. The majority of these consisted of Tatu's utterances with the sign BLACK. Two unprompted utterances by Tatu were coded as naming Properties. These were the THAT BLACK utterances, described below in section 4.3.5. The *1999* corpus contained 44 unprompted utterances, or 10.9% of the total. Request utterances accounted for 81.8% of them. The remaining 18.2% were Unclear, again being BLACK utterances by Tatu.

Of all corpora combined, 489 unprompted utterances or 93.7% were requests. Requests for objects took up 78.4% of the total, while requests for actions were made in

13.2%. There were 31 utterances in the Unclear category, which was 5.9% of the total. The only other intention was naming Properties, with two utterances.

Compared with the total of 2,839 prompted and unprompted utterances in the four corpora, the following things are of interest. All Naming utterances were found to follow a form of human prompting, except for the two Properties utterances by Tatu. The Answering intention also was no longer part of the intentions. However, this happened because of the particular definition of this intention (having to follow a human question, therefore disqualifying all Answering instances as unprompted). The combined total of request utterances went up from 86% of the prompted+unprompted total to 94% of the unprompted utterances only.

When the unprompted utterances are considered to show more clearly what the chimpanzees themselves want to sign about, the conclusion has to be that their intentions turn out to be even more focused on requests, with requests for objects taking up the vast majority. Unclear utterances, mostly in the form of utterances with BLACK by Tatu, are also made, but these do not provide a further insight into the underlying communicative intentions. Thus, the only other clear intention besides requests consists of Tatu's two THAT BLACK utterances, coded as naming Properties. However, two instances thus coded may not be such strong evidence for an intention (see also the remarks in section 4.3.5.).

These data can be compared with those of Miles' (1976) study with Ally. She had found that a third of Ally's utterances followed a Wh-question and were therefore solicited, in the terminology that Miles used. The communicative acts of solicited utterances were for 91% action requests and naming instances. Analyzing the unsolicited utterances she found that action requests and naming were still the largest categories, with 77%. However, the percentage of "other acts" had increased from 9 to 23%. Interestingly, this result is almost opposite of what was found with the unprompted utterances in this study.

Note that not all of the chimpanzee utterances that were considered prompted may actually have been unspontaneous. For example, when the human takes out an object from a bag or so, the chimpanzee may sign about that object out of a spontaneous motivation, rather than because of being prompted by the human. The total number of motivationally spontaneous chimpanzee utterances may therefore be larger than the numbers given above. However, this definition of "prompted" was used in order to ensure that the officially unprompted utterances were to a reliable degree unprompted.[333]

Conclusion on the communicative intentions of unprompted utterances. A total of 522 utterances is not prompted in any form by the human. This is 18% of the total number of utterances. The percentage of unprompted utterances for the *1992* corpus is 5 (11 utterances). In the *1993* corpus 30% is unprompted (355 utterances). This is 11% in the *1994* corpus (112 utterances) as well as in the *1999* corpus (44 utterances). Almost all of the unprompted utterances in the four corpora are requests for objects and actions: 94% of the total. Requests for objects are most frequent. They take up 78%, while requests for actions account for 14% of the unprompted total. Only two utterances with a naming intention are unprompted. These are two naming Properties utterances by Tatu. The remaining unprompted utterances are of the Unclear category (6% of the total).

3. SIGNS.

3.1. Frequencies. The 2,839 utterances of the combined four corpora consisted of 4,776 times that a sign was produced by one of the five chimpanzees.[334] Washoe used a sign 1,295 times, Moja 1,363 times, Tatu 1,348 times, Dar 661 times, and Loulis 109 times. As for the

[333] Obviously, the very presence of the human may function as a prompt. Thus one can go on and on in redefining promptedness. However, the used definitions at least ensure the least amount of human eliciting or prompting.

[334] As was mentioned in the Method chapter, immediate or successive repetition of a sign occurred with some frequency. However, as long as no new sign was made all immediate repetitions of a sign were counted as only one instance of that sign.

number of different signs that were used in these instances, Washoe used 43 different signs in total. Moja used 55 different signs altogether. Tatu used 55 different signs and Dar 38. Loulis only used 4 signs. The five chimpanzees combined used 88 different signs in total, with a mean of 39 signs. The particular signs and their frequencies that the chimpanzees used can be found in Appendix D.

Interesting here is that only three signs accounted for almost half the times that Washoe made a sign: COME/GIMME, with 339 times (26% of her total), FLOWER, made 149 times (12% of total), and GUM, 138 times (11%). This means that one in every four signs that Washoe produced was COME/GIMME. The other chimpanzees' use of signs was more varied, though all had signs that took up around 10% of the total of times that they used a sign. Moja used BRUSH the most, 125 times, or 9% of her total. Tatu used the sign BLACK 137 times or in 10% of the total times that she signed. DRINK (124 times) took up 9% of Tatu's total. Dar's most frequent sign was his own name sign, DAR, which he made 86 times and accounted for 13% of the times he made a sign. THAT was his second most frequent, with 58 times or 9% of his total.

With Loulis the situation is quite different. Loulis stands out from the other chimpanzees in the limited amount of signs that he used: only four. Three of these accounted for 96% of the times that he made a sign. He made THAT/THERE/YOU[335] 63 times (accounting for 58% of his total), GIMME 28 times (26%) and CHASE 14 times (13%). The only other sign he used was HURRY, made 4 times.

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[335] THAT, THERE, and YOU were considered to be variants of the same sign, because the configuration and movement were the same: pointing with an index. The place where the index was pointing to was the only difference and determined the interpretation as THAT (pointing to an object), THERE (pointing to a place), or YOU (pointing to a person). Though the interpretation of the chimpanzees' points as THAT, THERE, or YOU was reliably done in this study, it was considered an inflation of their sign vocabulary to interpret these different pointing behaviours as three completely different signs. The Gardners were the first to describe the pointing of the chimpanzees with the glosses THAT, THERE and YOU. Terrace, and Miles with the signing orangutan Chantek, however, did not use these glosses, but represented the pointing behaviour as POINT (though Terrace (1979a) did allow the glosses ME and YOU as separate from other POINTs). After POINT Miles put in parentheses the object or place the point was towards. For example, if Chantek pointed to a door, this was transcribed as POINT (door). If the ape pointed at the refrigerator it was written down as POINT (refrigerator). Miles (1983) got this more conservative interpretation of this sign from a suggestion by sign language expert Hoffmeister (1978; Hoffmeister & Wilbur, 1980). In current ASL research the pointing index gesture is often glossed as IND or INDEX (Meier, 1990; Sandler & Lillo-Martin, 2001).

When the most frequent signs of all five chimpanzees are combined, an intriguing picture results. Only 10 signs in total took up 60% of all the times that a sign was made. These signs are: THAT/THERE/YOU (741x), COME/GIMME (459x), DRINK (346), FLOWER (262), FOOD/EAT (200), SMELL (189), GUM (187), BRUSH (168), TOOTHBRUSH (162) and HURRY (159). The combined total of times that these most frequent signs were made is 2,873. This is 60.2% of the total times a sign was produced.

Though not intended to imply that the chimpanzees never use other signs from their vocabularies, it is interesting to compare the signs from the four corpora with the chimpanzees' official vocabularies. Using the chimpanzees' 1998 vocabulary lists of the CHCI, comparisons can be made between the signs made in the recent corpora and the individual chimpanzees' reliable and observed sign vocabularies. These data are presented in Table 4.13. In the second column the number is given for each chimpanzee of the different individual signs that were used in the recent corpora and that were part of the chimpanzee's reliable vocabulary. The third column then presents the total number of individual signs in the chimpanzee's official reliable vocabulary. The fourth column then gives the percentage of the total reliable vocabulary that the recently used reliable signs represent. The fifth column lists the number of different individual observed signs that were used in the recent corpora. The sixth column mentions the total number of signs within each chimpanzee's official observed vocabulary. In the seventh column the total number of signs used in the recent corpora is presented. This number is arrived at by adding the number of recently used reliable and observed signs. In the eighth column the combined official reliable and observed vocabulary is given for each chimpanzee, in number of individual signs. The last column then gives the percentage of the total reliable and observed vocabulary that was used by each chimpanzee in the four recent corpora.

Table 4.13. Signs used in the recent corpora compared to reported vocabularies.

	Reliable signs recent corpora	Reliable vocabulary	Percentage reliable vocabulary used	Observed signs recent corpora	Observed vocabulary	Reliable + observed vocabulary used recent	Reliable + observed vocabulary combined	Percentage reliable + observed voc used
W	41 signs	182 signs	22.5	2 signs	57 signs	43 signs	239 signs	18.0
M	51 signs	171 signs	29.8	4 signs	35 signs	55 signs	206 signs	26.7
T	49 signs	146 signs	33.6	5 signs	54 signs	54 signs	200 signs	27.0
D	37 signs	126 signs	29.4	1 sign	42 signs	38 signs	168 signs	22.6
L	4 signs	10 signs	40.0	---	67 signs	4 signs	77 signs	5.2

The reliable and observed vocabularies were based on sign checklists of the chimpanzees of the following dates: 10/09/98 for Washoe, and 09/21/98 for Moja, Tatu,[336] Dar and Loulis.

3.2. Semantic categories. The division of the recent signs and their frequencies into the semantic categories they were originally assigned to by the Gardners, led to the results presented in Table 4.14. The semantic categories are ordered according to rank of frequency in the four recent corpora. In the first column of the table, the semantic categories as defined by the Gardners are listed. The second column presents for each of these categories the number of times that a sign from that particular category was used in the recent corpora. Note that the Object, Person and Attribute categories have several subcategories and one category in which the totals of these subcategories are combined. The third column gives the percentage of the total times in which a sign was made in that particular (sub)category. The fourth column then gives the number of different individual signs within the category that were used in the recent corpora. The last column lists the most frequent individual signs within that category. In Appendix B all individual signs are listed with their exact frequency, specified per chimpanzee.

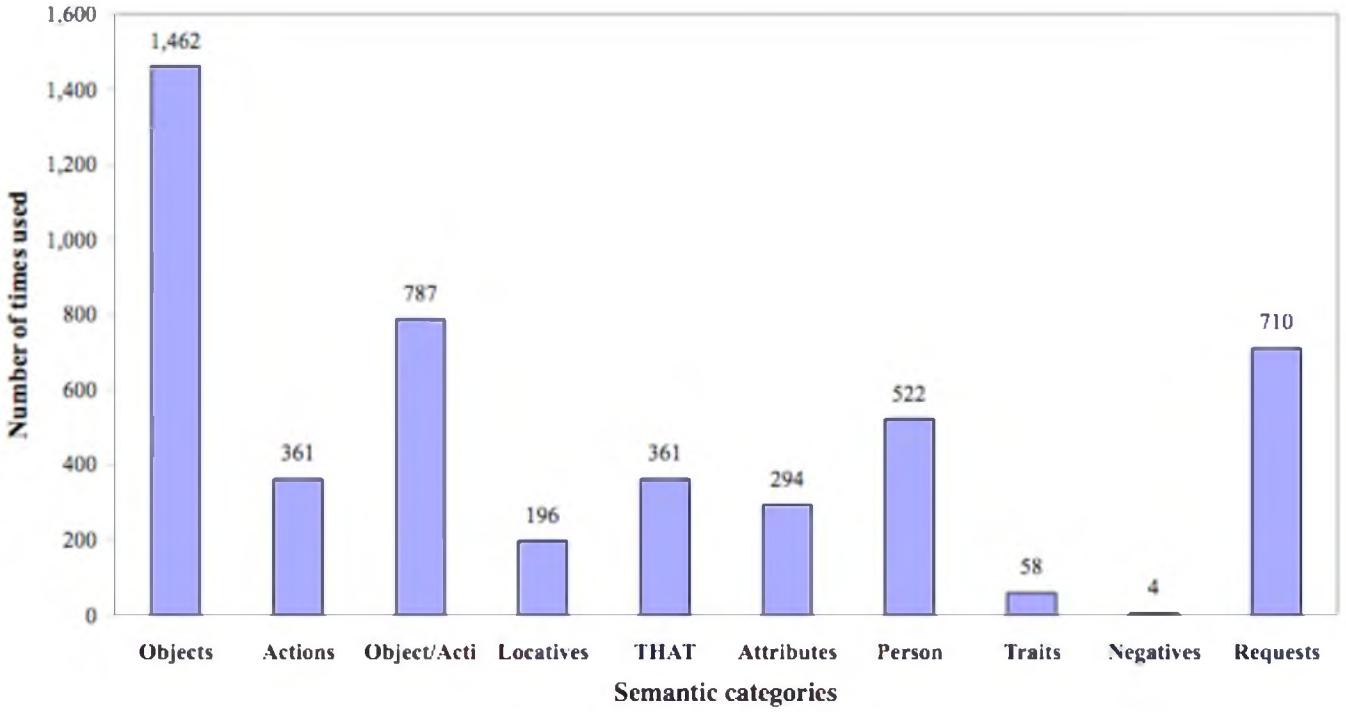
[336] The total for Tatu in this table, 54, is one sign less than her total mentioned in the text before the table. This is because one sign, GRASS (made only once), was not part of either her reliable or observed vocabulary and was therefore not included in the table.

Table 4.14. Semantic categories of recent sign use, ranked according to frequency.

Semantic categories	Times	Percent	Signs	Most frequent signs
Objects: All	1,462	30.6	47	
Objects: Edibles	1,015	21.3	30	FLOWER, GUM, COFFEE
Objects: Inanimates	403	8.4	13	TOOTHBRUSH, CLOTHES, SHOE
Objects: Animates	44	0.9	4	BIRD
Objects / Actions	787	16.5	10	DRINK, FOOD/EAT, BRUSH
Requests	710	14.9	5	COME/GIMME, HURRY
Person: All	522	10.9	9	
Person: YOU+ME	259	5.4	2	YOU
P: Names chimpanzees	247	5.2	4	TATU, DAR, MOJA
P: Generic names	12	0.3	1	
P: Names humans	4	0.1	2	
Actions	361	7.6	9	SMELL, CHASE, PEEKABOO
Demonstrative	361	7.6	1	THAT
Attributes: All	294	6.2		
Attributes: Colours	217	4.5	2	BLACK, RED
Att: Sensory qualities	77	1.6	2	HOT
Locatives	196	4.1	3	THERE
Traits	60	1.3	1	GOOD
Negatives	4		1	
Unclassified	21		1	PERSON

Figure 4.8 presents the frequency of the different semantic categories in the recent corpora in a graph. They are not ordered by rank of frequency as in Table 4.14, but according to the order withing the Gardner's division of semantic categories.

Figure 4.8. Recent frequency semantic categories (Gardners)



Each semantic category from which signs were used in the recent corpora will now be discussed separately, starting with the most frequent category.

Objects categories.

The most frequent semantic category the chimpanzees used was the Objects category. An object sign was the case in 1,462 times or 31% of the total. This Objects category consists of three different subcategories: signs for Edibles, signs for Inanimate objects, and signs for Animates such as animals.

Objects – Edibles.

Number of different signs used: 30. Listed in order of frequency of occurrence: FLOWER, GUM, COFFEE, CHEESE, NUT, WATER, CRACKER, MEAT, ICE/COLD, GRASS, BANANA, FRUIT, CORN, APPLE, PLANT, SODAPOP, TEA, CARROT, ONION, CEREAL, ICECREAM, TOOTHPASTE, MILK, RICE, COOKIE, SANDWICH, BERRY, ORANGE, POPCORN, and POTATO.

Edibles was the biggest subcategory, with 1,015 times or 21% of the overall total of times a sign was made by the chimpanzees. The signs FLOWER (262 times), GUM (187 times), and COFFEE (116 times) took up more than half of the times (56%) an edible-object sign was used.

Objects – Inanimates.

Number of signs: 13. Presented in order of frequency: TOOTHBRUSH, CLOTHES, SHOE, BOOK, LIPSTICK, HAIR, MASK,[337] BLANKET, HAT, KEY, WRISTWATCH, COVER, and HURT.

Signs for Inanimate objects were used 403 times (or in 8% of the total). The signs TOOTHBRUSH[338] (162 times) and CLOTHES (103 times) accounted for 66% of the times an inanimate object sign was used.

Objects – Animates.

Number of signs: 4. In order of frequency: BIRD, DOG, CAT, and COW.

The Animates category was used only 44 times or in 1% of the total. BIRD was the most frequently used sign in this subcategory (31 times).

Most of the times a sign for inanimates was used were by Moja, taking up the whole use of CLOTHES herself. Loulis did not make signs in any of the objects categories.

Objects/Actions.

The second category in frequency was Objects/Actions with 787 times or 17% of the total. Ten signs were used in this category, in order of frequency of occurrence: DRINK, FOOD/EAT, BRUSH, FLOWER/SMELL, DIRTY, OIL, LIGHT, SEE/GLASSES, COMB,

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[337] The signs MASK and PEEKABOO (see the Action category) are in fact the same sign. In the Gardners' categorization it was therefore an object/action sign. However, in the recent utterances the context allowed for a determination of the use of this sign as either MASK (in reference to the inanimate object mask) or PEEKABOO (referring to the action of playing peekaboo). Therefore the sign figures twice in this analysis, in both the inanimate object category and the action category.

[338] TOOTHBRUSH was officially grouped into the semantic category object/action by the Gardners. According to them the sign was used not only to refer to the object of a toothbrush, but also to the action of brushing one's teeth. This may have been the case in the early days, when the chimpanzees were taught to brush their teeth. In the recent sign use in the corpora, though, the context in which TOOTHBRUSH was used indicated that the chimpanzees referred only to the object. No recent utterances with the sign warrant a reference to the action of brushing one's teeth.

and HEAR/LISTEN. The three signs DRINK (346 times), FOOD/EAT (200 times), and BRUSH (168 times) accounted mostly for the times a sign was used in this category (91% of total times an object/action sign was used). Loulis did not make signs in this category.

Request markers.

Requests was the third most frequent semantic category: 710 times or 15% of the total, taken up largely by COME/GIMME (459 times, 65% of total times a request sign was used) and HURRY (159 times, 22% of request sign use). Three other signs were used in this category: MORE, PLEASE and TIME. Washoe had a disproportionately large use of request markers: She was responsible for 454 times or 64% of the total times in this category. Request markers took up 35% of the total times that Washoe made a sign. Tatu and Dar, on the other hand, used request markers considerably less. Tatu used them 100 times or in 7 % of her total. Dar only used request markers 34 times or in 5% of his total.

Person categories.

Person signs came next. They were used 522 times or in 11% of the total. This category existed of four subcategories: "Pronouns,"[339] Names of chimpanzees, Names of humans, and Generics for persons.

Person – "Pronouns."

This subcategory was used most frequently of the Person subcategories: 259 times. Two signs were responsible for these occurrences: YOU and ME, with YOU taking up most of it (237 times). Tatu and Moja made most use of YOU, while Washoe never signed YOU in the analyzed hours. Of the 22 utterances with ME, 17 were made by Washoe.

Names of chimpanzees.

Signs for the names of the chimpanzees, the next most frequent Person subcategory, were used 247 times. However, the chimpanzees only used their own name sign (with Loulis

[339] The name of this category also unjustifiably suggests an existing syntactic category, and is used here only to group together the signs ME, YOU, and WE.

making none in this subcategory). Thus there were 4 signs in this subcategory: TATU (made 88 times), DAR (86 times), MOJA (47x), and WASHOE (26x).

Generics for persons.

Dar was the only one using a sign from the subcategory Generics for persons. He signed BOY 12 times. This is a sign the humans use to refer to him, so it is comparable to Dar's name sign.

Names of humans.

There were four instances that officially belonged to the subcategory of Names of humans: 3x HEIDI by Dar and one ROGER by Tatu. However, the HEIDIs by Dar may have been sloppy versions of his more frequent sign BOY. BOY is made by the index and thumb, or thumb and fingers of a pincer hand grasping or pulling at the brow or temple. HEIDI is done by the index side of the H hand (palm down) contacting high on the brow or forehead, then drawing across the forehead and down the side of the face, as if outlining long hair down the face. With these two signs lying close to each other in PCM, sloppy BOYs may slip to a PCM by which they are interpreted as HEIDIs. When one looks at the instances in which HEIDI was used by Dar, it becomes even more likely that they were sloppy versions of BOY. Two of the instances were combined with DAR, in the same manner that he combined DAR with BOY: DAR HEIDI DAR and DAR HEIDI DAR THAT, compares to BOY DAR BOY and BOY DAR BOY DAR. All four of these utterances were answers to a WHO question or general questioning expression by the human.

The one time that Tatu used ROGER, the sign was clearly made. However, it was unclear from the context what she meant when she signed it (the utterance in which this sign figured was coded as Unclear for intention). Tatu used it in a session with Mark Bodamer, in which she first asked for ICE/COLD, CHEESE, MEAT, NUT, and BANANA. Eventually, after a DON'T-UNDERSTAND by Bodamer, she signed ROGER CHEESE, continuing later with asking for WATER and COFFEE.

Actions.

Fifth most frequent were the Actions and the Demonstrative category. They both were used 361 times or in 8% of the total. In the Actions category nine signs were used: SMELL, CHASE, PEEKABOO, HUG, GO, GROOM, TICKLE, CRY, and SWALLOW (in order of frequency). SMELL was most frequent, with 189 times.[340] It was only made by Moja and Tatu though. The other three chimpanzees did not ask for the routine in which the human blows their breath and the chimpanzee smells this. CHASE, PEEKABOO, and HUG were also frequent in this category. The sign HUG, however, when taking the context and communicative intention into account, appeared to be functioning more like a request marker rather than an action sign. It was made 38 times in the four corpora combined. It was signed 32 times by Washoe, five times by Moja and once by Tatu. HUG only appeared in request utterances, either as a single-sign utterance (6x) or in combinations such as HUG COME, HUG TOOTHBRUSH, FLOWER HUG, HUG HOT DRINK, FLOWER GIMME FLOWER HUG, or FLOWER HUG HURRY DRINK HURRY GIMME BOOK FLOWER. It was thus part of clear request utterances for certain objects or actions, sometimes in combination with official request markers such as GIMME or HURRY. There were no instances in which the sign referred to the action of hugging or where it functioned as a greeting or a request for reassurance.

Demonstrative.

The Demonstrative category in the form of the sign THAT was used in the same amount as the Actions category: 361 times or 8% of the total. The Gardners assigned all occurrences of THAT to this Demonstrative or naming category. In its recent use by the chimpanzees, THAT was often part of request utterances. The sign appears to have shifted in semantic

[340] The Gardners assigned the FLOWER/SMELL sign to the Objects/Actions category, the context determining whether the sign was referring to flowers or the act of smelling. In most recent utterances, however, it was clear from the context whether the chimpanzee was referring to a flower (in RQO utterances) or to the human action of blowing breath (in RQA utterances). In only 19 instances this was not as clear, so these were left in the Objects/Actions category, while the clear instances of FLOWER and SMELL were added to the Objects and Actions categories respectively.

category from the demonstrative to possibly another request marker. See further remarks on this later in this chapter at 4.3.7.

Attributes categories.

Signs for Attributes were next in line. They were used 294 times or in 6% of the total. This group of categories consists of six subcategories: Colours, Possessives, Materials, Quantitatives, Comparatives and Qualities. No signs from the Attribute subcategories Possessives, Materials, Quantitatives and Comparatives were used in the recent signing in the four corpora.

Attributes – Colours.

The subcategory Colours was largest here (217 times) and consisted of two colour signs: BLACK (137 times, only used by Tatu) and RED (80 times, used mostly by Moja). For remarks on Tatu's use of BLACK see its discussion at the communicative intentions section of this chapter and at section 4.3.5 below.

Attributes – Qualities.

Signs for sensory qualities was the other subcategory here (77 times), and consisted of HOT (54 times) and SWEET. HOT was only made by Washoe, and functioned more as an object sign to refer to hot drinks such as coffee. All her utterances with HOT were coded as requests for objects and there were none in which it was determined to be a description of the hot sensory quality of something. Six times the sign was used alone and the remaining instances in combinations. In these combinations it sometimes gave the appearance of referring to the quality of a drink or coffee (as in HOT DRINK and HOT COFFEE). However, the fact that she used it singly, as well as in combinations in which it did not appear to refer to a sensory quality, such as HOT GIMME, HOT GUM, HOT TOOTHBRUSH GIMME TOOTHBRUSH, and FOOD/EAT GIMME HOT HURRY GIMME UK, suggests more a reference to an object only. In some sessions Washoe would alternately ask for DRINK, then for HOT, then back to DRINK and more such variations. In most instances that SWEET was

made it did not appear to be a description of a sensory quality either. It looked more like a sloppy version of RED or GRASS. This is because most of the times it only appeared right before or after these particular two signs. In two other instances it was used by Tatu as an object sign for candy, when she was naming a picture in two *1992* sessions.

Locatives.

Locatives were used 196 times or in 4% of the total. This category was represented mainly by THERE (with 143 times). The other two signs here were IN (31 times) and OUT (22). IN and OUT are signs that are used in the CHCI to refer to the action of going into the outdoor area or back indoors. So these last two signs may not refer to locations, but rather to locative actions. Sometimes these signs, especially IN, appeared to function as a request to be let inside (therefore coded as Request for action utterances). In most other utterances with IN or OUT that were coded as requests, it was not as clear what the chimpanzee wanted, though the context suggested that he or she was asking for something. Eight IN/OUT utterances were coded as Unclear. Combinations added to the unclear nature of these signs: In nine utterances both IN and OUT were asked (7x IN OUT, 2x OUT IN). Combinations with request markers and object signs confirmed the lack of specificity of the locative signs. Thus Washoe signed: IN GIMMIE and OUT [IN] OUT [IN] GUM THERE GIMMIE.[341]

Traits.

The Traits category came next and consisted of only the sign GOOD, made 60 times. See below in section 4.3.5 and the sections on multiple-sign combinations for remarks on the interpretation of this sign. Its use appears to suggest a status as a wild card sign rather than an expression of the trait "good."

[341] A further notational remark: when a sign was imitated by the chimpanzee (according to the definition used) it was put in between brackets.

Unclassified.

In 21 instances the chimpanzees made a sign glossed as PERSON. This was a sign the chimpanzees acquired after the Gardner projects. Rather than referring to a person, it has been described by Roger Fouts as an attention-getting behaviour (see chapter 3.4.).

Negatives.

Lastly, there were four times in which Moja behaved as if she signed NO, by shaking her head sideways. However, in the context of the utterances in which she showed this behaviour it was not clear that she was protesting something or used it as a Negative. Her head-shaking behaviour may have been some sort of nervous behaviour rather than that it should be interpreted as making the sign for NO.[342]

Moja's use of SEE/GLASSES. Before continuing, a few remarks should be made on Moja's use of the sign SEE/GLASSES. Her use of this sign may not need to be interpreted as an action/object sign, nor as a reference to the act or state of seeing or looking. Most of the times that she used this sign it was to request another routine interaction, in particular one in which the human blows on his or her (sun)glasses and shows this activity to Moja. In a few other instances where she signed SEE/GLASSES it appeared as if she "said:" "show me this or that." These occurred in an interaction with a human in which Moja indicated that she wanted him to show more of his bodyhair. However, her use of SEE/GLASSES in these instances may be interpreted as a routine, without Moja intending to explicitly state that she wants to see something. It is plausible to infer from the context that she uses this sign to see more of something, but the way she uses it puts the sign on the same level with other single-sign requests such as SMELL or PEEKABOO. SEE/GLASSES was not used in varied utterances that could indicate a reference to the act or state of seeing. It was not used in combination with, for example, a person sign, as in I SEE or YOU SEE, nor in contrast to

[342] When deaf children first start to communicate negation at the age of 1 year, they use a negative headshake. This is used to reject other people's requests or suggestions. Bonvillian (1999) mentions that researchers do not consider this a linguistic sign yet, but instead a non-linguistic gesture. When they are 18 months old, deaf

other states, say for example in an utterance like MOJA NO SMELL MOJA SEE. Also, there was one interesting utterance in which Moja signed UK THERE GIMME FOOD/EAT GIMME SEE/GLASSES. She signed this in a context in which a human was blowing soap bubbles and had just stopped doing so before Moja made this utterance. The use of FOOD/EAT and SEE/GLASSES appeared as if she was searching for the right sign, but may also be interpreted to indicate that such signs have become so routinized that they can also show up at inappropriate times in order to make the human continue with whatever action that happened to be going on and had stopped immediately before. To conclude, the sign SEE/GLASSES was sometimes used in order to see more of something, but this is done in a routine fashion, comparable to the routine use of SMELL and PEEKABOO, without evidence that Moja explicitly states that she wants to see something.[343]

3.3. Imitation. In Table 4.15. the number of times that a sign was imitated or non-imitated are presented for each individual chimpanzee and each corpus.

Table 4.15. Number of times that a sign was imitated.

	VK		MB		MLJ		ER		All corpora	
Chimp	**I**	**-I**	**I**	**-I**	**I**	**-I**	**I**	**-I**	**I**	**-I**
W	34	84	139	715	70	379	24	117	267 (17.1%)	1,295
M	39	80	191	719	95	382	61	182	386 (22.1)	1,363
T	26	39	174	652	73	480	50	177	323 (19.3)	1,348
D	3	8	155	365	58	257	8	31	224 (25.3)	661
L	4	83					2	26	6 (5.2)	109
All	106	294	659	2,451	296	1,498	145	533	1,206	4,776
I + -I	400		3,110		1,794		678		5,982	
% I	26.5		21.2		16.5		21.4		20.2	

The percentage of imitation in the *1992* corpus was 26.5% of the total or 106 times that a sign was used. Big individual differences here were Tatu's percentage of 40, Moja's of 33, and

children start to use specific negative signs such as NONE and produce these without an accompanying headshake. At the age of 20 months they then combine signs and negative headshakes.

[343] Relevant to this discussion is the mentioning by the Gardners (1978) that Moja "requested her favorite cup, which was red and transparent, by signing *drink*, *cup*, *see*, or *red glass* at different times" (p. 53). Though this specific use of SEE may have originated because of the transparent quality of her cup, it shows that from very early on SEE was sometimes used in request utterances, in this case as an object sign that referred to the cup.

Loulis's, only 5. In the *1993* corpus there were 659 times that a sign was imitated. This amounts to 21.2% of the total times a sign was used in that corpus. There were only minor differences in the amount of imitation between the individual chimpanzees. The percentage of imitation in the *1994* corpus was 16.5% or 296 times, again with only slight individual differences. Lastly, in the *1999* corpus a sign was imitated 145 times, or in 21.4% of the total times a sign was made. As in the *1992* corpus, Loulis' percentage of imitation was considerably smaller than that of the other chimpanzees. In the *1999* corpus he only imitated a sign twice (1x THAT and 1x CHASE), or in 7% of the total of times (28) that he made a sign. Combining the imitation in the four corpora results in a percentage of 20.2% imitation. This means that four out of each five signs were spontaneously produced by the chimpanzee, but that every fifth sign could be considered an imitation of the human sign. Note that Dar and especially Loulis have a different total percentage of times that a sign was imitated. Dar has the largest percentage, 25.3, while Loulis has the smallest percentage, 5.2.

Terrace reported that imitation was a big part of Nim Chimpsky's signing. He looked at imitation on an utterance level rather than on the sign level. Thus he analyzed the proportion of utterances that were full or partial imitations (reductions) of the human, rather than the total times a sign was made that might have been imitated. Nim had a percentage of 34 of full or partial imitation at 26 months old, which increased to 54 at the age of 44 months. In the study on imitation in children by Bloom, Rocissano, and Hood (1976) fully and partially imitated utterances by children at Stage 1 accounted for 18% of their total (with a range of 12 to 23%). This went down to a meager 2% (range 0 to 4) when the children had entered Stage 5.

Above the number of times was calculated in which a recent sign could be considered an imitation. If the proportion of the total of recent utterances that were full or partial imitations of human utterances are calculated, the following new percentages result. In the *1992* corpus 28% of all utterances were full or partial imitations. Fully and partially imitated

utterances accounted for 19% of the utterances in the *1993* corpus. For the *1994* corpus this percentage was 14. In the *1999* corpus, lastly, 17% of the total of utterances were fully or partially imitated. Summing up all utterances of the four corpora and determining the percentage of fully or partially imitated utterances, results in a percentage of 18. This means that every sixth utterance the chimpanzees made in all four corpora, was either a full or partial imitation of a human utterance in the five seconds preceding it. This is a much lower percentage than those Terrace gave for Nim and is the same percentage of the human children at Stage I in the study by Bloom, Rocissano, and Hood (1976). Table 4.16. presents the numbers and percentages of utterances that were full imitations and reductions.

Table 4.16. Number of full imitations and reductions (utterances).

	VK		MB		MLJ		ER		All corpora	
Chimp	**I**	**-I**	**I**	**-I**	**I**	**-I**	**I**	**-I**	**I**	**-I**
W	26	59	59	249	33	232	9	72	127 (17.2%)	612
M	24	44	59	286	63	267	39	134	185 (20.2)	731
T	26	37	80	379	36	337	28	146	170 (15.9)	899
D	3	8	78	283	33	188	8	28	122 (19.4)	507
L	4	65					1	25	5 (5.3)	90
All	83	213	276	1,197	165	1,024	85	405	609	2,839
I + -I	296		1,473		1,189		490		3,448	
% I	28.0		18.7		13.9		17.4		17.7	

In column -I of this table all utterances were grouped together that contained no imitated signs at all or that consisted of imitated plus nonimitated signs (expansions). Note that the totals of utterances in this table and the table at the beginning of this chapter, Table 4.13., are different. In Table 4.13. all full imitations and reductions had been removed from the calculation, whereas they were added to Table 4.17. This means that the actual total number of utterances that the chimpanzees made in the four corpora combined was 3,448.

The corpora also made it possible to determine the percentage of expansions that the chimpanzees produced. In expansions the chimpanzees imitated one or more of the signs that were just made by the human, but added nonimitated, novel signs to these. In the *1992* corpus

there were only twelve expansions, which amounts to 4% of the total of utterances in that corpus. The *1993* corpus had the largest percentage of expansions of the four corpora: 15. Expansions accounted for 10% of the utterances in the *1994* corpus. Finally, expansions occurred in the *1999* corpus in 8% of the total of utterances. The combined percentage of expansions in the four corpora together is 11%. This is comparable to Nim's reported expansions percentage of 7%. It is lower than the expansion percentage reported for children by Bloom, Rocissano, and Hood (1976). At Stage 1 they expanded adult utterances in 21%, which increased to 42% at Stage 5.

3.4. Conclusions on individual signs. The 2,389 utterances consist of 4,776 times that a sign is made. The five chimpanzees combined use 88 different signs in these utterances. Washoe uses 43 different signs. Moja and Tatu make use of 55 different signs, while Dar uses 38 and Loulis 4 different signs. These numbers mean that the chimpanzees use about a third of their reliable vocabulary in the utterances of the four corpora. All chimpanzees have signs that occur very frequently. Three signs account for almost half the times that Washoe makes a sign: COME/GIMME, FLOWER, and GUM. Every fourth sign that she makes is COME/GIMME (26% of her total). Moja's most frequent sign is BRUSH (9% of her total). Tatu's most frequent signs are BLACK (10% of her total) and DRINK (9%). Dar's most frequent signs are DAR (13% of his total) and THAT (9%). Three of Loulis' signs take up 95% of his total: THAT/THERE/YOU (58%), GIMME (26%) and THAT (13%). Ten signs account for 60% of all the times that the five chimpanzees make a sign: THAT/THERE/YOU, COME/GIMME, DRINK, FLOWER, FOOD/EAT, SMELL, GUM, BRUSH, TOOTHBRUSH and HURRY.

In terms of semantic categories, the chimpanzees mainly use signs for objects (31%), objects/actions (17%) and for actions (8%), as well as request markers (15%). Person signs occur in 11% of the total, and are predominated by YOU and the chimpanzee's own name signs. The use of the sign THAT (8% of the total) indicates that the sign is more used to

request rather than to demonstrate an entity. Two colour signs are used: BLACK (only used by Tatu) and RED (mostly used by Moja). There are two signs for qualities: HOT and SWEET. However, HOT appears to refer more to an object, while the instances of SWEET may have been sloppy signing of other signs. Locatives are mainly represented by THERE. The sign GOOD is the only trait sign, but functions more as a wild card sign. Four instances of Moja shaking her head sideways (glossed as NO) do not suggest an interpretation as a negative, but may be some form of nervous behaviour.

Twenty percent of the times that a sign is made in the four corpora the sign is an imitation of a human sign. Four out of five times that a sign is made the sign is spontaneously produced by the chimpanzees. In terms of utterances, 18% of the total of utterances in the four corpora are full imitations or reductions, containing only signs imitated from the human. This is much lower than the percentage reported for Nim (34 to 54) and comparable to the number reported for children. In 11% the utterances are expansions, consisting of imitated signs combined with nonimitated ones. This percentage is close to that of Nim and lower than that of children.

First intermediate summary of main results.

The following results on the chimpanzees' sign use in the four recent corpora have been presented up to now:

- Requests for objects and actions predominate the chimpanzees' communicative intentions when making signed utterances.
- Signs for objects and actions, request markers, and other signs that function to request (THAT, GOOD) are the most frequently used signs.
- Several signs are made very frequently: Ten signs account for 60% of the times a sign is made.

- Imitation of a human sign occurs in 20% of the times a sign is made. Full imitations and reductions take up 18% of the total of utterances. In 11% the utterances are expansions.

4. COMBINATIONS OF SIGNS.

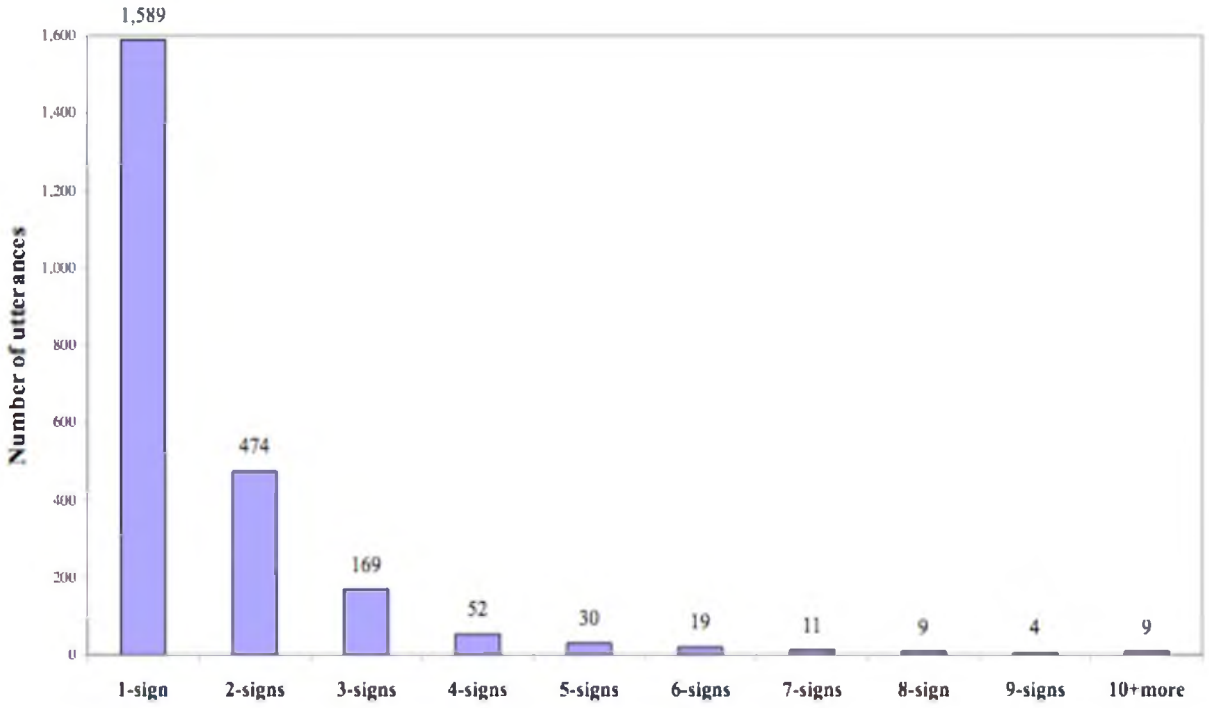
4.1. Number of signs per utterance.

Though not intending here to determine the mean length of utterance, it is of interest to present the frequencies of the particular number of signs within an utterance. In 2,366 of the total of 2,839 utterances none of the signs were imitated from the human nor did they contain an unclear or unidentifiable sign. The remaining 473 utterances with an imitated or unclear sign were not included in the analyses below.[344] Including utterances with imitated signs would not show the spontaneous length of the utterances that the chimpanzees made. Also, their inclusion in the interpretation of semantic relations might result in mistaking a semantic relational look for actual semantic relations (see the cautionary remarks in section 2.2.2.). Unclear signs also made an interpretation of the length difficult. This is because an unclear sign may not have been a proper sign. If it was a sign, its unclear nature made it impossible to determine whether it was an imitated sign. Obviously, two-sign combinations with an unclear sign could not be interpreted for semantic relations.

In Figure 4.9. the 2,366 chimpanzee utterances are grouped according to the number of signs present in the utterance.

[344] However, the clear and nonimitated signs within these utterances were used in the tallies for the frequencies of signs in section 3.1., and these 473 utterances were coded for communicative intention and included in the totals there.

Figure 4.9. Number of signs per utterance



Notice here that 1,589 or 67% of the total were utterances of only 1 sign. There were 474 two-sign combinations, or 20% of the total. Three-sign utterances made up 7% of the total, 169 instances. Four-sign utterances were present 52 times, five-sign utterances 30. Six-sign utterances occurred 19 times, seven-sign utterances 11 times, and eight-sign utterances: 9. The number of nine-sign utterances was 4 and 10-sign utterances 3. Then there were two 11-sign utterances, and lastly, 13-, 15-, 17-, and 22-sign utterances were each made once.

During these latter longer utterances, however, the human interlocutor sometimes made one or more utterances while the chimpanzee, according to the definition that was used, was still busy with his or her utterance. When human interruptions like these occur, the chimpanzee may continue signing in response to the interrupting human utterance(s). The human interruptions may therefore artificially increase the length of the chimpanzee utterance. They occurred mostly in the *1993* corpus. See the example that was presented in chapter 4.2.5.

4.2. Two-sign combinations.

There were 474 utterances that consisted of a combination of two signs. Of these, 232 utterances or 49%, were combinations with an object sign. Two-sign combinations (41%) containing an object/action sign (mainly FOOD, DRINK, and BRUSH) occurred 195 times. A combination with a person sign (mostly with the sign YOU or the chimpanzee's own name sign) took place 121 times or in 26%. Then, 22% were combinations with a request sign (104 instances). Of the two-sign utterances 21% were combinations with the sign THAT (101) and 11% were combinations with an attribute sign (54). In 8% the chimpanzees made a combination with a locative (39). Sixteen two-sign combinations (3% of the total) concerned a combination with an action sign, and lastly, 5 instances (1% of total) were combinations with a trait sign.

4.3. Semantic relations.

In order to assess the possible presence of semantic relations the Gardners' category system was used as an initial division of the recent two-sign combinations into candidates for the different types of relations (see its description and Table 4.10 in the Method chapter). For each type of semantic relation, the Gardners specified one or more combination types that expressed that relation. For example, three types of combinations expressed the Object+Action relation. These were combinations of an object sign and an action sign; an object/action sign and an object sign; and the demonstrative THAT with an object sign.

In the presentation below, for each of the semantic relations the published examples of chimpanzee combinations are first listed. According to the Gardners and Fouts these were instances of that semantic relation. Then the tokens of recent two-sign combinations found in the four corpora are given for each of the relation's combination types. These tokens will then be tried as candidates for the semantic relation. This is done by taking into account the context, the utterance's communicative intention code, and other information, such as the

previous and subsequent contingent utterances, and the use of the individual signs within the combination in 1-sign utterances. Alternative explanations will then first be tried that are not in need of an interpretation in terms of semantic relations. It will also be taken into account that for a semantic relation to be actually present, the two semantic roles within the relation should be represented by a variety of signs rather than finding maybe stereotypic patterns with one particular sign only.

4.3.1. Object+Action.

The Gardners have given examples of past chimpanzee sign use in this relation type, such as OPEN BLANKET. They specified three combination types (with examples) that fitted this relation:

- object+action: BALL CATCH, GROOM HURT.
- object/action+object: DRINK SODAPOP, EAT APPLE.
- demonstrative+action: THAT OPEN, THAT CATCH.

Applying these combination types to the recent two-sign combinations the following information results.

Object+action. There were only 2 two-sign utterances of the object+action type: CHASE TOOTHBRUSH and HUG TOOTHBRUSH. These are exactly like the combinations that were mentioned in chapter 3.4. (such as GUM CHASE) that do not appear to express the Object+Action relation, because both combinations would not make much sense in such an interpretation. Also, HUG was often part of request utterances and appears to have become functioning more like a request marker rather than an action.

Object+object/action. Then there were 68 object+object/action combination tokens. More than half of these, 35, were combinations with the object/action DRINK. Only about a third of these, 13 combinations, might be interpreted as Object+Action: 9x DRINK+COFFEE, and 4x DRINK+WATER. The other 22 combinations with DRINK, however, do not appear to make sense and seem more like juxtaposing two different things

that the chimpanzee requests at the same time. They were: 3x DRINK+FLOWER, 4x DRINK+BIRD, 4x DRINK+GUM, 3x DRINK NUT, 2x DRINK+MEAT, 2x CORN DRINK, and 1x: DRINK COLD (COLD refers to ice), CHEESE DRINK, SHOE DRINK and DRINK TOOTHBRUSH.[345]

The same situation is the case with combinations of objects and the object/action sign FOOD/EAT, of which there were a total of 14. Most of these could be interpreted as making sense: 2x FOOD/EAT+CHEESE, 2x MEAT FOOD/EAT, 1x GUM FOOD/EAT, 1x NUT FOOD/EAT, 1x FOOD/EAT APPLE, 1x CEREAL FOOD/EAT and 1x FOOD/EAT FRUIT. However, again, there were also lesser apparently sense-making ones: 3x FOOD/EAT COFFEE, 1x CLOTHES FOOD/EAT, and 1x WATER FOOD/EAT.

The combinations of objects with the object/action sign BRUSH point even more toward an explanation of these combinations as asking for two things at once, rather than making meaningful expressions of relations between the two signs. There were eight object-combinations with BRUSH, four of which were with TOOTHBRUSH, which is not suggestive of an Object+Action interpretation. This is because the chimpanzees' sign BRUSH refers to brushes for clothes or hair, or the action of brushing, but not to the action of brushing one's teeth. Nor do the following combinations that all occurred once suggest the Object+Action relation: BRUSH CRACKER, BRUSH SHOE, SODAPOP BRUSH and APPLE BRUSH.

There were 10 more object+object/action combinations, which were again more suggestive of the chimpanzee asking for two things at once: 2x FLOWER PEEKABOO, PEEKABOO BOOK, CARROT OIL (OIL refers to grease or to oiling things, but in recent days also to lotion), MEAT OIL, 2x MEAT SMELL (made by Tatu, who first asked for these two things in separate 1-sign utterances), and DIRTY GRASS (where DIRTY may have been a sloppy version of GRASS, because the two signs are close to each other in PCM). Lastly,

[345] A further notational remark: a plus between the two signs of a combination means that this combination was made with both possible orders; no plus in between means that only that particular order was made in the

there were two SMELL HAIR combinations. In one of these, Moja had been signing SMELL after which the human blew his breath towards her. Moja then signed SMELL again, was interrupted by the human asking SMELL WHAT, after which Moja signed HAIR. This sequence was counted as one utterance, because, though she was interrupted, her signing movements continued. There may therefore not have been a true combination and the HAIR (which sign is a point to the head) may have been a separate answer to the human's interrupting WHAT question. In the *1999* sessions (both SMELL HAIR combinations come from one human cage situation in this corpus) Moja asked the humans to show and manipulate their hair in 1-sign HAIR utterances. The other SMELL HAIR instance was not interrupted by the human. However, the HAIR was such a slight touch of the hair on her own head that the human interlocutor did not notice it. The human then reacted by only blowing his breath towards her, and did not manipulate or show his hair. Later in the conversation Moja asked for hair manipulation by signing HAIR in a clearer way (the human then showed and played with his hair) and for more SMELL as well (to which the human blew more towards her). However, because Moja made these requests of the human in 1-sign SMELL and 1-sign HAIR utterances, with no further instances the SMELL HAIR combinations do not need to be interpreted as expressing the Object+Action relation either.

Notice that there were only a few object/action signs that occurred in these combinations. The general purpose signs DRINK and FOOD/EAT made up 49 combinations or 72% of the total here, which suggests that FOOD/EAT and DRINK may also have become some sort of wild card signs, useful to make in many contexts, or to add further emphasis to a request.

All of the used object/action signs (DRINK, FOOD/EAT, BRUSH, OIL, PEEKABOO, and SMELL) were made more often as 1-sign utterances. These were usually requests, so again, an interpretation as instances of the Object+Action relation is not necessary even in the utterances that appear to make sense.

Demonstrative+action. The last possible Object+Action candidates are combinations of THAT with an action, where the interpretation is that the chimpanzee expresses an action that he or she wants to be performed with the object that he or she is pointing at. There were only seven of these two-sign combinations, 4x THAT CHASE, 1x HUG THAT, and 2x GROOM THAT. Three of the THAT CHASEs were part of Loulis' exhortations for the human to engage in action. The context of the other combinations also did not suggest an Object+Action relation, except for GROOM THAT. However, because this is the only example that might fit, there is no reason to warrant an interpretation in the form of the Object+Action relation here either.

4.3.2. Agent+Action.

In the Gardners' system there are two combination types that express this relation:

- person+action: GROOM DAR, YOU TICKLE, SUSAN CHASE, ME OPEN, NAOMI HUG.
- person+object/action: SUSAN BRUSH, YOU BLOW, YOU WRITE, TATU DRINK

Notice the variety of different agents here.

In the recent corpora 57 utterances or 47% of all two-sign combinations with a person sign were candidates for the Agent+Action relation.

Person+action. Only one of the candidate utterances was a person+action combination. It was DAR TICKLE, made by Dar. This utterance was coded as a request for action and was preceded by 1-sign CHASE requests. One could interpret this utterance as beneficiary+action or patient+action, rather than Agent+Action. However, as will be clear from the data on the name sign use by the chimpanzees, the DAR here may have been a wild card sign added for emphasis. A semantic interpretation of this combination is therefore not necessary.

Person+object/action. Of the 56 person+object/action combinations, most were by Tatu: 39. Thirty of her combinations were a pairing of SMELL and YOU. All of these were

coded as requests for action from the human. Rather than describing that the human interlocutor was smelling, the YOU referred to the human as benefactor or fulfiller of her request. Five combinations existed with Tatu's name sign, all made in the *1993* corpus: 4x DRINK TATU and 1x FOOD/EAT TATU. Three of these were preceded by 1-sign requests for DRINK or FOOD by Tatu. One of these three followed the human question ...LOOK-THERE WHERE, another followed the human utterance GO COME, and the third the human denial NO COFFEE. The two other combinations, two DRINK TATU utterances, happened at the very beginning of two *1993* sessions. These were the first utterances so there were no preceding human or chimpanzee utterances. All five utterances with TATU were coded as Request for Object. They appear to specify Tatu as beneficiary. They can also be interpreted as Tatu obligatorily adding her name sign in order to satisfy the human's demand to sign more before the human fulfils a request. Tatu's further four person+object/action utterances, 2x YOU DRINK, 1x FOOD/EAT YOU, and 1x YOU PAINT, were, again, preceded by 1-sign requests for DRINK, FOOD and PAINT. They were not descriptions of the human drinking, eating, or painting, but reaffirming that the human should get her something to drink, eat, or paint with.

Moja and Dar were the only other chimpanzees who had person+object/action combinations. As with Tatu, all of these are interpretable as specifying themselves as the beneficiary of some activity, or adding YOU to the activity they want the human to carry out. Moja's instances were: 8x SMELL YOU, and the following made once: BRUSH YOU, FOOD/EAT YOU, LOOK YOU, DRINK YOU, and DRINK MOJA. Dar's were: DAR BRUSH, DRINK DAR, LIGHT YOU, and BOY LIGHT.

Note that in all of these person-combinations the chimpanzees only used YOU and the name signs of themselves. There were no instances like SUSAN BRUSH and NAOMI HUG, made in the early years. This fits Terrace's description of Nim's use of person signs. Nim used only NIM or ME in 99% of object+beneficiary combinations, and only YOU in 76% of

the agent+object combinations. This threw doubt on the interpretation of these combinations as semantic relations, where a large variety of signs is needed to infer their presence. The use of NIM, ME, and YOU in these combinations may have been more a habit or routine that developed along the course of Project Nim, because such utterances caused the humans to give Nim what he wanted more easily.

In the utterances with ME that the chimpanzees produced in the recent corpora (of which there were no tokens of two-sign combinations of the format ME+object/action), this sign similarly showed to be redundant in information. Usually they were produced after the chimpanzee (mostly Washoe) had already uttered several requests of which the obvious recipient was herself. For example, Washoe signed DRINK ME DRINK after she had made several unfulfilled requests for DRINK (without the human asking WHO).

In conclusion, the way the chimpanzees recently used their own name sign can well be interpreted as a routine, or a wild card that they can throw in when the human does not immediately fulfil their request, or as an obligatory answer to any question the human asks, whether this is WHO, WHAT, or WHERE. The wild card interpretation will become even more plausible when the multiple-sign combinations will be discussed (section 4.4. and further).

In the descriptions of the usage of YOU the Gardners have said that Washoe and the other cross-fosterlings used this sign to indicate the human in turns of games such as tickle and hide, turns during food-sharing, and other activities (Gardner & Gardner, 1969; Gardner, Gardner & Nichols, 1989). The SMELL YOUs in the recent combinations were similar to this use of YOU in the early years, with the exception that there were no more turns taken in the interaction sessions of the recent corpora: It was always the human's turn and the chimpanzee did not sign SMELL ME, like they apparently did in the early years. This means that the general use of YOU has been, and still is, more a sign that relates to the human getting into action, rather than that it is a referential expression similar to the English *you*.

4.3.3. Locative action.

Gardner examples of this relation have been given for the combination types:

- locative+action: GO UP, TICKLE THERE, GO OUT.
- locative+object/action: BRUSH THERE, DRINK HOME.
- locative+person: ME UP, TATU DOWN.

A total of ten recent two-sign combinations were the candidates for this relation. There were no locative+action combinations.

Locative+object/action. There were seven locative+object/action combinations, all with THERE: 2x SEE/GLASSES THERE, 2x DRINK THERE, 1x BRUSH THERE, 1x FOOD/EAT THERE, and 1x THERE SMELL. Four of these were coded as Request for Objects, so these utterances can be interpreted as pointing towards a place where the BRUSH, DRINK, and FOOD as objects were, rather than to the place of the actions of brushing, drinking, or eating. THERE SMELL was made by Tatu in a human cage session of the *1999* corpus. A human was sitting in front of the enclosure with several objects, amongst which several flowers and a cup. The human had put up one flower towards Tatu and signed SMELL THAT FLOWER at 52:08. Tatu then signed THERE SMELL at 52:17, pointing towards the floor, where more objects were lying. Though Tatu apparently wanted something, it was unclear what she exactly meant. The human responded with asking Tatu THERE? WHAT? Tatu's THERE SMELL was coded as a Request for action. Last to describe are the two SEE/GLASSES THERE combinations. They were made by Moja in another human cage session of the *1999* corpus in which she was asking to see more of a human's body hair. Both utterances followed a WHAT question by the human, and the pointing index of THERE was directed towards the human's body. They might therefore also have been transcribed as SEE THAT, if one considers the human body to be an object rather than a location. In the conversation in which the SEE THEREs occurred Moja had first asked for the blowing routine by signing SMELL. She then asked HAIR THERE, pointing to the

human's chest. These were followed by the SEE THEREs, where the THEREs pointed to the human's chest and belly respectively. The utterances were coded as requests for action. The human reacted by opening his shirt so Moja could see more of his body hair. These two combinations with SEE might be more appropriate as action+demonstrative rather than action+locative.

Locative+person. Locative+person combinations were the following three: Moja: MOJA THERE, Tatu: YOU IN, Dar: IN DAR. Again, as with the other person-combinations, Tatu's YOU IN was more asking the human to be let in. The MOJA THERE occurred after Moja had been asking for clothes and can be interpreted as throwing in her name sign in order to get the human to fulfil her request (the human signed PLEASE right before), rather than that it refers to Moja being brought or going somewhere. The IN DAR can be interpreted again as "wild card name sign use," because it followed a 1-sign request for IN.

4.3.4. Object+Locative.

The Gardners' combination type for this relation:

- locative+object: IN KEY, NUT THERE.

There were 16 recent combinations of object+locative. All of these were, again, with THERE, except for one utterance with IN. Six were by Moja: 3x FLOWER THERE, 1x CLOTHES THERE, 1x HAIR THERE and 1x ONION THERE. Tatu had seven object+locative combinations, all with THERE: 3x FLOWER THERE, 2x PLANT THERE and 2x THERE+LIPSTICK. Three were by Dar: 2x SHOE THERE, and IN BANANA. The IN BANANA is unlikely as a description of an object, and is more plausible as requesting two different things. The utterance followed 1-sign requests for IN. The combinations with THERE appeared more like pointing towards the place where the specific objects were that they wanted from the humans, rather than that they gave a mere description of objects being at a certain specific location.

To conclude on both the Locative action and Object+Locative relations, there is a pattern in the chimpanzee combinations of requested item + pointing towards a place where the item can be found. However, this may not be sufficient enough in terms of a variety of signs to call this pattern a semantic relation. Remember Terrace's words in this regard on page 98 in chapter 2.2. He found that 90% of Nim's location combinations were sequences with the locative sign POINT, which added fuel to his conclusion that the small number of exemplars in the semantic roles did not warrant an interpretation of the combinations as an expression of semantic relations

4.3.5. Attributive.

Gardners combination types and examples:

- attribute+object: BLACK HAT, GLASS MIRROR, BLACK DOG, RED ICECREAM;
- attribute+object/action: RED TOOTHBRUSH, HOT DRINK;
- attribute+demonstrative: THAT WHITE, THAT RED;
- and person+trait: GOOD BOY, QUIET ME, DAR SORRY

Attribute+object. There were 12 attribute+object combinations. However, it is questionable whether these should be interpreted as semantically related. This shows in particular with the combinations with colour signs. Moja only used the sign RED, which was her favourite colour according to the impression of the humans at the CHCI. Her utterances were: 4x RED CLOTHES, 1x RED SHOE and 1x RED NUT. In terms of describing the colour of objects in these utterances, the context did not show objects that were of that colour. They may have been lying on the shelves of the playroom, but this was not possible to determine on the videotape. The utterances have all been coded as requests for objects. Because Moja did not use another colour sign it is not possible to say that she used RED as a colour sign. She did, however, make requests for objects with 1-sign RED utterances. It may therefore be that RED has shifted to become more of an object sign, referring to clothes. This use of the sign may well have been stimulated by the humans' perception of red being her

favourite colour. The humans may have waited for her to make the sign RED before they gave her clothes or other objects, causing a similar fate for RED as for the name signs: throw it in when you want something because this may please the humans and cause them to deliver your request quicker. Some of Moja's utterances longer than two signs with RED throw further doubt on the interpretation of the sign as a colour term. Moja signed utterances such as RED MOJA RED, RED YOU BRUSH, THERE RED GIMME, RED DRINK CLOTHES RED, and BRUSH RED BRUSH RED YOU RED.

Tatu only used what was considered to be her favourite colour sign in her combinations, BLACK. These were the instances: 2x BLACK TOOTHBRUSH, and 1x CHEESE BLACK. However, with these utterances too, it is unclear whether she was describing the colour of objects. One of the BLACK TOOTHBRUSHes was coded as Unclear in terms of intention, so the context did not clearly include the presence of a black toothbrush. The other BLACK TOOTHBRUSH and CHEESE BLACK were coded as requests for objects rather than property or attribute descriptions. There was also no black toothbrush or cheese present when these utterances were made. The use of BLACK seems more to function as the habit Tatu has to sign BLACK frequently, where it not always appears to be related to the colour black.

This is not to say that the chimpanzees never described the colours of objects, because there were eight utterances for which the intention had been coded as describing the properties (colours) of objects. The instances were all by Tatu, and she used both BLACK and RED. Six of these were 1-sign utterances with a colour sign. The two combinations consisted of the combination attribute+demonstrative and will be discussed below.

The remaining attribute+object combinations did not appear to strongly indicate the relation either. Washoe made COFFEE HOT once, but HOT in 1-sign utterances often functioned as a request for a hot drink, so again there is the possibility of her asking twice for the same thing rather than connecting hot and coffee. The other combination with HOT by

Washoe, HOT GUM, is a good example of combining two request items that were regularly asked for in 1-sign utterances.

Then there was SWEET, used once by Moja in the combination SWEET CLOTHES. The context did not suggest that Moja referred here to a possibly sweet quality of clothes. The SWEET may have been a sloppy version of RED. These signs are close to each other in PCM (they are described in chapter 5). In the *1993* session in which she made this combination, Moja had been signing the utterances RED CLOTHES RED and RED immediately before the SWEET CLOTHES utterance.

Attribute+object/action. There were four utterances of this type. Washoe signed HOT DRINK. As mentioned above, Washoe asked for hot drinks in 1-sign HOT utterances, so this pairing does not have to mean an expression of an attributive relation. Moja made BRUSH RED once, again two things that she frequently asked in 1-sign requests. Tatu, lastly, made SMELL BLACK and DRINK RED. SMELL BLACK may be ruled out as describing the blackness of a smell and points to her use of BLACK as a habitual addition to her utterances. DRINK RED was coded as Unclear and was preceded by the human question WHAT COLOR? The sign COLOR is close to the sign RED, so it may be that Tatu was only imitating the human here when she signed RED.

Attribute+demonstrative. Combinations of attribute+demonstrative were made 18 times. Tatu made 16 of these, which were all combinations of BLACK and THAT. Of these, two THAT BLACKs were coded as naming the property of an object, so in these instances the relation may be there. However, again, there is no variety of signs, and indeed, there are only two instances. This is little ground to infer the presence of the Attributive relation. With the other instances of this combination type, rather than pointing to something that was black and giving its colour name, the intention codes were either requests or unclear. The context did not show a clear black object that was pointed at. The other two combinations in this particular subcategory were two RED THATs made by Moja. They were both coded as

requests (where one RED may have been a sloppy FOOD) rather than descriptions of an object's colour.

Person+trait. Lastly, there were two combinations of person+trait. These were not indicative of describing attributes either. The only trait used was GOOD. One of them was combined with the chimpanzee's own name sign: DAR GOOD. The other combination with GOOD was YOU GOOD, also made by Dar, and was coded as a request for object after he had been asking for IN and EAT. The context did not suggest that the human was being assigned the quality of GOOD, but rather that Dar was separately pointing to the human as the one to get into action, while adding the human-pleasing sign GOOD. GOOD has been a sign the human sometimes asks about the chimpanzee, in questions such as YOU GOOD?, when the chimpanzee wants something. Rather than really describing they are good, this sign may function, like the name signs, as another wild card that is thrown in to please the human and make the fulfillment of requests happen quicker. In that sense GOOD is comparable to the sign SORRY and its function to manipulate humans (see footnote 70 in section 2.1.3.). Like with the name signs, this function of GOOD will get even clearer when the combinations of more than two signs are discussed.

To conclude this relation, there are two instances of Tatu's THAT BLACK that were coded as describing properties. As has been said several times now, such a small number of instances and lack of variety of exemplars of the semantic roles within the relation do not justify the conclusion that a true semantic relation has been found in the chimpanzee combinations.

4.3.6. Possession.

Old examples: BIB MINE, HAT YOURS, YOUR SHOE, MINE DRINK, DIRTY MINE, and THAT MINE.

In the recent sign use there were no two-sign combinations with either MINE or YOURS. Neither of these signs were used in the analyzed hours of the four corpora.

4.3.7. Nomination.

The Gardners' combination types and examples:

- demonstrative+object: THAT CAT, THAT SHOE, THAT HAT.
- demonstrative+object/action: THAT DRINK.
- demonstrative+person: THAT NAOMI.

Of the recent combinations with the sign THAT, only four have been coded as one of the naming intentions. These are 2x THAT ICECREAM, made by Tatu while she was looking at a picturebook, coded as Naming, and her 2x THAT BLACK which were coded as naming Properties (just described in 4.3.5.). Of the remaining 97 utterances with THAT (which besides combination types of THAT with an object, object/action, or person sign also included combination types of THAT with an action sign, an attribute, or a request marker) 82 have been coded as requests for objects or action (the other intentions for the two-sign THAT combinations were: 14x Unclear, 2x naming Properties and 1x Answering). It appears that the THAT sign in these instances serves more as an attention-drawer or exhorter of the human towards the object or action the chimpanzee wants. This same situation is the case with the combinations of more than two signs with the sign THAT. None of these were coded as Naming, but all received the code Request for object or action. Because naming objects and pictures was a clear and existing communicative intention in these chimpanzees, it is actually rather surprising that only 2 of the total of 101 two-sign combinations with THAT can be interpreted as an expression of the nominative relation. This may show that the THAT sign has shifted somewhat from the semantic category of demonstrative to an indicative request marker.

4.3.8. Experience/Notice.

The Gardners had two combinations types for this relation:

- object+SEE, SMELL, or HEAR: FLOWER SMELL, SEE FLOWER.
- person+SEE, SMELL, or HEAR.: SEE SUSAN, TATU HEAR.

In the recent corpora there were only utterances with SMELL. However, rather than suggesting a description of experiencing or noticing things, they were all part of request utterances for the routine in which the humans blow their breath so the chimpanzee can smell it.

One might consider Moja's SEE THERE combinations as candidates for the Notice/Experience relation. They were not of the combination types that the Gardners had specified for this relation. They were locative+SEE rather than object or person+SEE. In the discussion of the two SEE THERE tokens at 4.3.3. it was shown that SEE in these instances appeared to function more as a request for the human to show Moja more of something, rather than an expression that she noticed (the existence of) something. The combinations with SEE, like those with SMELL, then, do not express "calling attention to the existence of an object," usually including "notice verbs" such as "see," or "look," which is the way Bloom, Hood, and Lightbown (1974) defined this relation.

4.3.9. Negative.

Gardners examples: NO HAT, BRUSH NO, POTTY CAN'T, NO CHASE, CAN'T OUT, FINISH OUT.

There was only one instance of this category in the current data: Moja signing PEEKABOO NO. However, it was coded as a request for action and occurred after she had already made five utterances in which she requested things that were not fulfilled by the human. So again, as was said in 4.3.2. above, the NO seems to be more a nervous behaviour than an actual sign.

4.3.10. Requests.

Gardners combination types and examples:

- request+object: MORE COOKIE, GIMME MILK, MORE BALL.
- request+object/action: GIMME DRINK.
- request+action: HUG PLEASE, MORE GO.

- request+locative: MORE UP, OUT PLEASE.
- request+demonstrative: GIMME THAT, THAT MORE.

There were a total of 97 two-sign combination tokens of a request sign and another sign. Of these 45 were combinations of mostly the request markers GIMME and HURRY with an object sign. Combinations of GIMME and HURRY (Tatu also used TIME here) with the object/actions FOOD and DRINK occurred 22 times. Then there were two request+locative combinations: IN GIMME and HURRY THERE. One combination was a request+action relation according to the Gardner rules. It was COME GIMME, made by Washoe. However, it can be interpreted as that both signs separately exhorted the human to give her what she wanted, rather than that she wanted the human to give "coming," which would not make sense. Twelve utterances were combinations of HURRY and GIMME with THAT, of which seven were Loulis's. Ten further ones were combinations of request markers with a person sign, which do not figure in the Gardners' tables or examples and do not appear to indicate a relation. They were, again, examples of name signs used more like wild cards in order for the chimpanzees to get what they wanted: Washoe: 2x WASHOE GIMME, 2x ME GIMME, 2x HURRY+ME; Moja: MOJA GIMME, HURRY YOU; Tatu: TIME TATU; and Dar: GIMME DAR. Washoe made four combinations of an attribute sign and a request marker: 3x HOT GIMME (for drinks) and 1x RED GIMME (coded Unclear). The last combination with a request marker was with the unclassified PERSON sign: PERSON HURRY by Washoe.

Of all semantic relations, this one is most clearly there. That is, if one should interpret the combinations with request markers in that way. There is a variety of request markers and request items, fulfilling the variety of exemplars for the semantic roles within a semantic relation. However, one might still interpret these combinations as not related, because the request markers can also act as wild card signs with little or no specific reference.

4.3.11. Sequences may be semantic but not an expression of semantic relations.

Before moving on to the next subject, something more should be said on the combinations of object and action signs with the pointing sign THAT/THERE/YOU. They were found to occur with some frequency in the Agent+Action relation and the two types of Locative relations. However, these instances did not conform to the requirements of a semantic relation. This was because of the lack of variety in signs in the agent category (only YOU) and the location category (only THERE). Nevertheless, these combinations can still be considered to have a semantic structure, because the chimpanzees express that the human should carry out an action (YOU) or the place of a desired object or action (THERE). However, because they do not fulfill the criterion for semantic relations these meaningful combinations are not similar to the semantic relations that human children produce. The chimpanzee combinations may be semantic, but they may not be linguistic.

4.3.12. Conclusion on semantic relations.

There is no clear evidence for the presence of semantic relations in the two-sign combinations. The signs of most candidate combinations that have been examined can be interpreted as unrelated to each other. Several combination types appear to consist of object or action signs with wild card signs that add emphasis to the request. Combinations with the sign THAT/THERE/YOU may indicate that a human should carry out an action (YOU) or may specify the location of a requested object or action (THERE). However, because there is no variety of signs in these semantic roles these types of combinations do not fulfill the requirements for the presence of semantic relations.

Second intermediate summary of main results.

The following results on the sign use in the four corpora by the chimpanzees have been presented up to now:

- Requests for objects and actions predominate the chimpanzees' communicative intentions when making signed utterances.
- Signs for objects and actions, request markers, and wild card signs are the most frequently made signs.
- Several signs are made very frequently: Ten signs account for 60% of the times a sign is made.
- Imitation of a human sign occurs in 20% of the times a sign is made. Full imitations and reductions take up 18% of the total of utterances. In 11% the utterances are expansions.
- The majority of the chimpanzee utterances consist of 1-sign utterances.
- There is no clear evidence for semantic relations in two-sign combinations.

4.4. Three-sign combinations

There were 169 three-sign utterances in the four corpora. A large number of these, 70 utterances or 41% of the total, were utterances in which one sign was repeated twice, such as FLOWER GIMME FLOWER, DRINK GUM DRINK, RED CLOTHES RED, SMELL YOU SMELL, FOOD CHEESE FOOD, DAR ME DAR, and THAT CHASE THAT. A further six three-sign combinations were redundant in that two different request markers were used in combination with a requested item, such as GIMME DRINK PLEASE and HURRY GUM GIMME.

In 44 combinations two signs for objects or actions were combined with:

- a request marker: 14 utterances, with examples such as: TOOTHBRUSH GIMME GUM and FLOWER TOOTHBRUSH HURRY;
- the sign YOU: 9 utterances, like BRUSH YOU NUT and CHEESE YOU DRINK;
- the signs THAT or THERE: 9 utterances, like BANANA TOOTHBRUSH THAT, PEEKABOO SHOE THERE, and CLOTHES TOOTHBRUSH THERE;

- the signs FOOD/EAT or DRINK: 8 utterances, such as CHEESE DRINK COFFEE and FOOD/EAT MEAT CHEESE;
- the chimpanzee's own name sign: 3 times: DRINK FOOD/EAT MOJA, ICE/COLD DRINK TATU, and CHEESE DRINK TATU; or
- the sign GOOD: 1 utterance: GOOD BRUSH CLOTHES.

Nine further three-sign utterances consisted of combining three object or action signs which the chimpanzees normally used in 1-sign request utterances. Examples were: NUT BRUSH TOOTHBRUSH, DRINK GUM APPLE, SMELL POTATO FLOWER, CHEESE BRUSH SHOE, and OUT TICKLE EAT.

Sixteen other three-sign utterances were combinations of an object or action sign together with a request marker, which were combined with the signs FOOD/EAT or DRINK (e.g., FOOD/EAT FLOWER GIMME, CHEESE FOOD TIME, and DRINK GIMME HOT), the chimpanzee's own name sign (e.g. GUM WASHOE GIMME), the signs THERE (e.g., THERE RED GIMME), YOU (e.g., BRUSH YOU HURRY), THAT (FOOD/EAT GIMME THAT), or GOOD (GOOD FLOWER HURRY). Eight further ones were combinations of an object or action sign, the chimpanzee's own name sign, and one of the signs THAT, THERE, or GOOD (with examples such as MOJA THAT TOOTHBRUSH, TATU DRINK THERE, and TATU COLD GOOD), or the signs FOOD/EAT or DRINK (such as FLOWER FOOD/EAT MOJA and DRINK WATER TATU).

In addition, there were four three-sign utterances which consisted of an object or action sign plus two signs from the THAT/THERE/YOU/GOOD group: CLOTHES GOOD YOU, BRUSH THERE GOOD, DRINK THERE GOOD, and GOOD GUM THAT.

The remaining three-sign utterances have all been coded as requests. Though they do not fit one of the above categories, they are quite similar to what was already presented. They are: GIMME DRINK RED, GUM DIRTY HURRY, PERSON HURRY THAT, BIRD

FLOWER DOG, DRINK GO BOOK, CLOTHES BRUSH RED, YOU BLACK SMELL, BLACK YOU SMELL, BLACK SMELL YOU, and SWEET DIRTY GRASS.

One of these last three-sign utterances is worth some further attention. It is BIRD FLOWER DOG, made by Washoe as an answer to the question WHO SAYS (MEOW)? by Jensvold. From the first years with the Gardners, the signing chimpanzees were often participating in a particular game in which the humans produced an animal sound and then asked the chimpanzee for the sign of the animal that makes that particular sound. The number of different animals that could be used in this game was small, because the chimpanzees had only a few signs for animals. In the game the humans asked questions such as WHO SAYS (RUFF)?, WHO SAYS (TWEET)?[346] The particular answers CAT, DOG and BIRD were often seen as responses from the chimpanzees in this game. However, not always correctly. This gives the impression that, rather than understanding the questions and giving correct, purposeful answers, the chimpanzees learned that in the context of this game BIRD, DOG, and CAT, are important signs to make. The recent answer by Washoe just given is an interesting demonstration of this. Her reaction to the meowing sound of Jensvold is to produce BIRD and DOG, with a possible request for edible plants interspersed in between. In the published examples of responses in the object signs vocabulary test by the Gardners (1984, 1989) similar stringing of animal signs appear. Moja would sometimes respond with both CAT and DOG, on occasion making a repetition as in the utterance CAT DOG CAT DOG. Washoe, in response to a picture of a kitten, made the string of signs CAT BIRD DOG MAN. In the tests all four cross-fosterlings made frequent mistakes with the three animal signs. Washoe's most frequent mistake was to sign CAT for birds (11 times). Tatu frequently signed COW for cats and Dar identified slides of cats on 25 occasions as DOG (see Figures 7 to 9 in 1984). The field records also showed that the chimpanzees made errors such as signing CAT when DOG would be the appropriate answer in a particular context. The Gardners explained these errors as having occurred by confusion because all these signs

belonged to the same conceptual group of animate objects. It may well be that conceptual closeness is the reason for these mistakes, but maybe part of the explanation must be sought in the frequent playing of the animal sounds game, which then caused routine answer patterns.

Combinations in which more than one agent was specified, as in the Gardner examples YOU ME IN and SUSAN CHASE DAR, have not been found in the three-sign combinations from the recent corpora. Nor have any of the other more informative utterances with which the Gardners represented the chimpanzees' multiple-sign utterances. However, the recent three-sign combinations fit the description by Terrace and colleagues of the apes' longer combinations of signs.

4.5. Four-sign combinations.

A total of 52 four-sign combinations from the four corpora was used for analysis. 31 of these, or 60% of all four-sign combinations, are utterances in which one or two of the signs were repeated, such as FLOWER THAT FLOWER THAT or GUM FLOWER GUM TOOTHBRUSH. Rather than giving more information (such as another agent, or the location, see the Gardners' description as given in chapter section 2.2.5.), these all fit Terrace's description of repeating signs for emphasis only, without increasing the informativeness of the utterance.

The other four-sign combinations consist of object and action signs together with (in the by now familiar way) request markers, the chimpanzee's own name sign or the signs YOU, THERE or GOOD. One utterance consists of four object signs: FLOWER DRINK GUM TOOTHBRUSH. Six utterances consist of three object or action signs combined with a request marker, such as FLOWER HOT HURRY GUM and CLOTHES HURRY TOOTHBRUSH BRUSH. One utterance has three object or action signs combined with THERE: DRINK THERE BRUSH CLOTHES. Two utterances are a combination of two

[346] The animal sound in parentheses was made by the humans with their voice and was not signed.

object or action signs and two request markers: DRINK HURRY GIMME TEA and HUG DRINK GIMME BOOK. One utterance consists of an object sign and three request markers: FLOWER COME HUG GIMME (where HUG and COME appeared to function as exhorting the human to fulfil the request). The remaining 10 four-sign combinations are: DRINK GIMME GOOD FLOWER; THERE BRUSH GIMME DRINK; DRINK GOOD YOU BRUSH; CLOTHES RED THERE YOU; GOOD GIMME DRINK TATU; PERSON GIMMIE TOOTHBRUSH THAT; FOOD/EAT WASHOE GIMMIE CORN; FLOWER YOU SODA GOOD; CARROT BLACK THAT GIMME; and TOOTHBRUSH YOU BRUSH THERE.

4.6. Combinations of five signs and more.

As mentioned in section 4.1., there are 82 utterances that consisted of five signs or more, some of these stretching to 22 signs. Most of these are from the *1993* corpus. These longer utterances follow the same pattern as found in the three- and four-sign combinations: frequent repetition and redundancy takes place, as well as combining several object and action signs (that are often used as 1-sign request utterances) with request markers, the chimpanzee's own name sign, or the signs YOU, THAT/THERE or GOOD. Note that this pattern indicates that there is a large overlap between the utterances of different lengths. Single sign and multiple sign utterances consist of object or action signs, request markers, the chimpanzee's name sign and signs from the THAT/THERE/YOU/GOOD group. The repetition and redundancy characteristic of all multiple sign utterances is another form of overlap between three-sign up to 22-sign utterances.

There are a few individual differences in the number of longer utterances that the chimpanzees make. Especially Washoe and Moja make long concatenations of signs. The longer they get, the more they look like Nim's longest combination (presented in section 2.2.5.). For example, Washoe's one 13-sign combination (which was not interrupted by the

human) goes as follows: DRINK HOT GIMME DRINK TOOTHBRUSH GUM HOT GIMME TOOTHBRUSH GIMME TOOTHBRUSH GUM BOOK. An 11-sign combination by Moja (again without interruption) was: BRUSH CLOTHES THERE BRUSH THERE TOOTHBRUSH THERE BRUSH GIMME BRUSH THERE. And an example of an uninterrupted 9-sign combination by Tatu: COFFEE DRINK WATER DRINK COFFEE WATER GO-YOU NUT TEA.

As an example of strings of multiple signs, the following conversation with Washoe clearly shows this phenomenon. It contains a combination of 17 signs that was not interrupted by the human. It is session 5 of Tape 1 of the *1993* corpus.

Most of the multiple sign utterances were coded as requests for objects or actions. It is unclear in what way the object or action signs within these combinations function. The chimpanzees may be requesting the referents of both signs at the same time, thus wanting both a toothbrush and some gum when they sign TOOTHBRUSH GIMME GUM. Another possibility is that the signing chimpanzee wants one particular thing (maybe the referent of the first sign in the utterance) and then couples it with other signs, indicative of a signing strategy to sign more in order to increase the chances of getting something from the human. It may also be the case that the chimpanzees are not specific at all in what they request in these utterances, but are only stringing signs in unrelated ways in order to obtain anything. They may thus not request the referents of the two or more signs they have combined, but produce multiple signs to emphasize that they want something. Or it may function as a strategy to string signs so that one of them at least may hit right with the human interlocutor and spur the human into action to give the chimpanzees something. This latter possibility of unrelated sequencing to manipulate the human, may be the more plausible one, when one considers the nature of the multiple sign combinations of three and more signs.

Tape 1 - Session 5

Nr.	Time	Washoe signs	Time	Human signs
1	32:11.5 - 32:16.1	FLOWER GUM		
2	32:16.9 - 32:26.3	FLOWER BOOK TOOTHBRUSH HURRY-THERE GUM		
3	32:27.7 - 32:47.4	FLOWER HURRY FLOWER HUG GO FLOWER BOOK FLOWER GIMME FLOWER GIMME FLOWER HUG HURRY DRINK GIMME		
4	32:48.5 - 32:51.0	BOOK		
			32:51.1 - 32:51.3	WHAT
5	32:52 – 33:04	FLOWER BOOK DIRTY DRINK HURRY FLOWER HUG		
			33:04.9 - 33:05.8	WHAT FLOWER
6	33:06.0 - 33:19.9	FLOWER HUG HURRY DRINK HURRY GIMME BOOK FLOWER		
7	33:20.9 - 33:27.8	FLOWER TOOTHBRUSH HURRY		
			33:30.3 - 33:31.1	WHERE FLOWER
8	33:30.4 - 33:34.5	BOOK FLOWER GO		
			33:31.8 - 33:32.1	WHERE
			33:34.0 - 33:35.8	WHERE THERE WHERE
	33:35.9 - 33:37.8	FLOWER		
			33:37.3 - 33:37.6	WHERE
9	33:38.6 - 33:41	DRINK GO BOOK		
			33:41.0 - 33:41.8	WHICH BOTH
10	33:42 - 33:47.9	FLOWER		
			33:42.9 - 33:44.4	FLOWER DRINK BOTH
			33:44.9 - 33:46.5	HUH WHICH FLOWER WHERE
			33:47.7 - 33:50.1	THERE GO-THERE YES
	33:48.7 - 33:48.9	FLOWER		
			33:50.4 - 33:50.7	GO

Duration: 1 minute and 41 seconds.

This is not to say that the chimpanzees are never specific in what they request and always make strings of signs that may not refer to the things they want. Most of their sign use in the recent corpora consisted of 1-sign utterances. Sometimes the sign referred to an object or action that was part of the context. It is of interest to further analyze the nature of the shorter and longer utterances. Maybe some of the longer utterances were the result of human interruption, as was mentioned earlier. Or they may occur because the human does not react

immediately by fulfilling a request so the chimpanzee produces signs until finally the human gets into action.

Conclusion on multiple-sign utterances.

In all the different lengths of combinations of three signs and more the following characteristics can be discerned. Repetition of signs within the same utterance occur frequently. Redundant signs are added. Multiple signs for objects and actions are stringed together. Also, object and action signs are combined with request markers, or with the chimpanzee's own name sign and the signs THAT/THERE/YOU, and GOOD. This suggests that these latter signs all function as wild card signs. The similar nature of these different lengths of multiple-sign utterances means that there is a large degree of overlap between them. The multiple-sign utterances do not provide more information in the way that children's multi-word utterances are more informative.

4.7. Sign order.

A clear pattern of order preferences exists in the recent combinations in the four corpora. The following rule is present: Object signs, action signs, and object/action signs, are all more frequent in initial than in final position. Request markers, and the signs THAT/THERE/YOU and GOOD are all more predominant in the final rather than the initial position. This pattern is the case in both the two- and three-sign combinations.

The details of order preferences in two-sign combinations were as follows. The sign YOU occurred most often in final position: in 60 (or 85%) of 71 utterances. Combinations with a name sign had no clear difference: in 23 utterances it had the initial position, and in 17 the final position. Combinations with a request marker showed a preference for the request marker in final position. This was the case in 65 out of 97 utterances (67%). In combinations with an object sign the object sign appeared more often in initial position: in 126 or 64% of

198 two-sign combinations with an object sign. For two-sign utterances with an action sign there was a similar difference: 9 out of 15 times it occurred in initial position. Combinations with an object/action sign also showed a preference for the initial position: 116 or 63 % of the total had the object/action sign as first sign.

Two-sign combinations with an attribute also had a clear pattern: in 44 (or 81.5 %) of the 54 two-sign utterances with an attribute, the attribute sign was in initial position. The Gardners had reported that Moja, Tatu and Dar significantly put signs for attributes more frequently before person and object signs, rather than after these. In the recent signing, this was the case as well: 26 versus 4 two-sign combinations had the attribute sign before a person or object sign. This appears to be an interesting finding, and may be suggestive of some grammatical ordering. However, as was already discussed in section 4.3.5. on the candidates for the attributive semantic relation, there are some problems with the recently used signs that were officially assigned to the Gardners' attribute category. Almost two thirds of the 54 two-sign combinations with an attribute, 35 utterances, consisted of Tatu using the unclear sign BLACK, which does not always appear to refer to an attribute. A further six two-sign attribute combinations were Washoe's utterances with HOT, which appears to function by itself as an object sign. The remaining two-sign combinations with an attribute consisted of Moja's RED utterances (besides a SWEET CLOTHES by Moja, and a RED GIMMIE by Washoe). As was mentioned before (3.4.5.), usually the context did not clearly include the presence of red objects. These were her utterances: 4x RED CLOTHES, 2x RED THAT, RED NUT, RED GOOD, RED SHOE and BRUSH RED.

In further comparison with the earlier data reported by the Gardners, there were no combinations in the recent multiple sign utterances where YOU and ME both appeared in the same utterance. It can therefore not be determined whether the chimpanzees still have a YOU-ME-action sequence or a YOU-action-ME format. Nor could Washoe's use of YOU be examined, because none of her two-sign combinations contained YOU. As for her five recent

two-sign utterances with ME, three of these had ME in initial position, and two in second position, which is not much of a difference.

The rule that the Gardners found in the signing of four chimpanzees that THAT/THERE in demonstrative phrases was put in initial position, and in final position in locative phrases, could be assessed for its presence in the recent signing. When the recent two-sign combinations with THAT/THERE are considered, however, there is no real difference. In both types of utterances the majority of instances had THAT/THERE in the final position. 73 of the 101 two-sign utterances with THAT had THAT in final position (72 % of the total). With THERE, in 24 of the 26 utterances THERE was in final position (thus a percentage of 92%).

When one looks at the initial and final position in the three-sign utterances the following data result. Object signs were more frequent in initial than in final position: 63 versus 45 times (no action or object/action signs were present in the initial or final position). Request signs and the THAT/THERE/YOU/GOOD group were more frequent in the final position rather than the initial one: 70 compared to 41.

In conclusion then, there is a clear pattern in the order of two- and three-sign combinations. Leaving aside the more problematic category of combinations with an attribute, the following rule exists:

Table 4.17. Pattern of order preferences in two- and three-sign combinations.

Initial position	Final position
Object signs Action signs	Request markers THAT/THERE/YOU GOOD

This pattern of object and action first, and request markers and THAT/THERE/YOU/GOOD last, bears some resemblance to what has been called a "pivot grammar" or "pivot-look" in early child combinations (Braine, 1976; Brown, 1973; Tomasello & Brooks, 1999). These combinations are produced by a formula which contains one constant element (the pivot) and

one variable slot. One example is "more + various different objects," which can lead to productive combinations such as "more milk" and "more cookie." In these pivot-look combinations a consistent pattern exists for the order in which the pivot-type word and the variable word are combined. Tomasello & Brooks (1999) presume that these ordering patterns are derived from the input children have had from adult speech. They note, however, that the word order patterns in pivot-type constructions are not syntactic, that is they are not involved in modifying the meaning of the utterance. Though children may usually make the combination "Juice gone," the reverse, "Gone juice," does not change the meaning. The pivot-type constructions are thus not syntactic.

Also, the resemblance of the chimpanzee pattern with the pivot-type constructions is not that strong. There is a clear pattern of "object/action + request markers/THAT/THERE/YOU/GOOD," but the resulting combinations actually contain two variable elements. Obviously, if one looks at only a part of the utterances, there exist combinations with one constant element, for example, the object term GUM, which gets combined with variable terms such as "GUM THERE," "GUM GIMME" and "GUM GOOD." At the same time, however, the first element varies as well, leading to combinations such as "FLOWER THERE," "TOOTHBRUSH GIMME," and "DRINK GOOD."

The order pattern is, however, surprisingly well interpretable within the framework of an acquisitive motivation. The majority of the chimpanzees' utterances are requests for objects and actions. Object and action signs are therefore the more important or salient signs, which makes it understandable that they are signed first. Initial signs receive the first attention and the initial position might be considered to be the most important or salient one. Request markers and the THAT/THERE/YOU sign can be considered as signs that are of lesser importance, because they do not specify what it is the chimpanzee requests. Their function is more to spur the human into action or to add emphasis to the request. This would account for their final position. The division between object and action signs on the one hand,

and request markers and signs from the THAT/THERE/YOU/GOOD group on the other, was also evident in the multiple sign combinations of more than two signs. Besides repeated or redundant signs, most of these consisted of object or action signs in combination with request markers or signs from the THAT/THERE/YOU/GOOD group.

The order preferences found in the recent signing thus fuel the interpretation of their motivation as acquisitive. They do not suggest a grammatical structure in any way. The pattern found is purely accountable by functional explanations only and does not need to invoke a semantic or grammatical structure in the combination of signs by chimpanzees.

Conclusion. A clear pattern of order exists in the two- and three-sign combinations. This is that object and action signs occur more often in the initial position of an utterance, while request markers and the signs THAT/THERE/YOU and GOOD appear more frequently in the final position of an utterance. This order preference is not syntactic, but can be interpreted as the expression of an acquisitive motivation.

5. Name sign use.

Though some results have already been presented about the use by the chimpanzees of their own name sign, for reasons of clarity it is useful to present these data together.

All chimpanzees except Loulis made their name sign in the recent corpora (though none were made in the *1992* corpus). Washoe signed WASHOE 27 times. It was her 12th most frequent sign. Moja signed MOJA 44 times. It was also her 12th most frequent sign. Tatu made even more frequent use of her name sign. She signed TATU 87 times, making it her 6th most frequent sign. With Dar his name sign DAR was even his most frequent sign of all. He used it 86 times, or in 13% of the total of times that he made a sign.

Most of the utterances containing a name sign were given in response to a human Wh-question. In the *1993* corpus 35 utterances of the Answering utterances contained a name sign. 30 of these were 1-sign utterances. Five were the following two-sign combinations:

FLOWER WASHOE, DAR COFFEE, DAR BRUSH, DAR GOOD and DAR GRASS. Most of the Answering utterances with a name sign followed a WHO question by Bodamer, but five times they were made after a WHERE question, and another five times after a WHAT question. Once Tatu gave her name sign in response to Bodamer asking WHICH COFFEE CHEESE. All of these name sign utterances occurred later in the conversation, after the chimpanzee had already uttered several requests. These had not been immediately fulfilled by the human. Instead, the human reacted with one of the Wh-questions. The same pattern of name sign use in response to human Wh-questions was the case with the Answering utterances in the *1994* corpus and two of these in the *1999* corpus.

Besides the chimpanzee's own name sign being part of Answering utterances, it also figured often in request utterances, usually request for objects. In the *1993* corpus Tatu made the five following combinations: 4x DRINK TATU and 1x FOOD/EAT TATU. Three of these were preceded by 1-sign requests for DRINK or FOOD by Tatu. One of these three followed the human question ...LOOK-THERE WHERE, another followed the human utterance GO COME, and the third the human denial NO COFFEE. The two other DRINK TATU utterances happened at the very beginning of two *1993* sessions. These were the first utterances so there were no preceding human or chimpanzee utterances. These combinations appear to specify herself as beneficiary. However, they can also be interpreted as the chimpanzee obligatorily adding her name sign so the human may fulfil her request more quickly.

Throughout the decades of the signing projects the humans often asked WHO when the chimpanzees requested something. The human asking WHO and the chimpanzees giving their name sign may well have become so routinized that the chimpanzees gratuitously throw in their name sign even without the human asking WHO.

There were another 32 two-sign combinations containing a chimpanzee name sign that were coded as requests for objects or actions. Washoe had the following further two-sign

combinations: 3x WASHOE+GUM, 2x WASHOE GIMME, 2x WASHOE+FLOWER. Moja's request name sign utterances were: CLOTHES MOJA, DRINK MOJA, MOJA THERE and MOJA GIMME. Tatu had the following coded as requests: TATU PLANT, COFFEE TATU, TIME TATU, and ICE/COLD TATU. Lastly, Dar had the following: 6x DAR THAT, 2x DAR+TOOTHBRUSH, 2x DAR+GRASS, DAR BRUSH, DAR COFFEE, DAR TICKLE, DAR GOOD, DRINK DAR, IN DAR, and GIMME DAR. All of these name sign combinations were coded as requests and they were all made later in the conversation, when the chimpanzee had already uttered one or more unfulfilled requests. The combinations of a name sign with a request marker further add to the interpretation of the name signs as wild cards useful to thrown in at any time, to expedite the human into fulfilling their requests at last.

The way that the name sign was part of the multiple-sign utterances longer than two signs further confirms their wild card interpretation. The following multiple-sign utterances with a name sign were not made after the human asked the chimpanzee WHO?, or after the human pointed YOU to the chimpanzee. Nor were these chimpanzee utterances interrupted by such human utterances while they were signing. Altogether there were the following 16 such three-sign utterances containing a name sign. Washoe made one: GUM WASHOE GIMME. Moja had three: MOJA THAT TOOTHBRUSH, FLOWER FOOD/EAT MOJA and DRINK FOOD/EAT MOJA. Tatu had nine: TATU PLANT THAT, TATU FLOWER THERE, CHEESE DRINK TATU, TATU COLD GOOD, DRINK WATER TATU, WATER DRINK TATU, TATU DRINK THERE, TATU COFFEE TATU, and COLD DRINK TATU. Dar, lastly, had the following three: GUM DAR GUM, DAR GOOD THERE, and BOY DAR BOY. Then there were the following six such four-sign combinations in which the chimpanzee's own name sign figured. Washoe signed FOOD/EAT WASHOE GIMMIE CORN. Tatu had three: FOOD TIME FOOD TATU, DRINK MILK DRINK TATU, OIL TATU THAT OIL. Dar had two: DAR HEIDI DAR THAT, BOY DAR BOY DAR. Tatu had

the longest of such utterances with a name sign. They were two eight-sign utterances in which TATU figured twice: ME TATU DRINK WATER TATU COFFEE DRINK YOU-HURRY, and COFFEE TATU YOU WATER DRINK TATU YOU COFFEE.

A good example of frequent name sign use within one particular conversation is found in the transcription of session 18 of Tape 5 of the *1993* corpus.

Tape 5 – Session 18

Nr	Time	Tatu signs	Time	Human signs
1	11:53.1 – 11:58.6	DRINK WATER DRINK WATER COFFEE		
2	11:59.4 – 12:00.5	WATER DRINK		
3	12:01.2 – 12:01.6	TATU		
4	12:02.0 – 12:02.2	TATU		
			12:04.4 – 12:04.6	WHAT
5	12:04.7 – 12:19.1	DRINK COFFEE DRINK WATER DRINK COFFEE		
			12:20.3 – 12:22.0	NO DRINK COFFEE
	12:22.0 – 12:22.3	COFFEE		
6	12:23.9 – 12:25.6	YOU-HURRY		
7	12:27.7 – 12:28.4	COFFEE		
8	12:29.3 – 12:31.4	TATU	12:29.3 – 12:29.5	COFFEE
			12:30.0 – 12:33.5	YOU ME MINE COFFEE
	12:33.4 – 12:33.7	COFFEE		
	12:35.1 – 12:35.6	MINE		
			12:35.3 – 12:38.3	ME YOU ME YOU MY NOT YOUR
			12:41.4 – 12:42.5	WHO COFFEE
9	12:42.3 – 12:42.5	TATU		
			12:43.8 – 12:47.5	NO MY COFFEE ME SHARE YOU
10	12:47.3 – 12:49	DRINK TATU YOU DRINK YOU		
			12:51.1 – 12:57.8	YOU WANT WATER IN YOU WATER NOT COFFEE
11	12:52 – 12:56.2	TATU WATER YOU WATER COFFEE		
12	12:58.2 – 13:02.9	FOOD WATER FOOD(?) DRINK HURRY-YOU		
			12:58.9 – 13:01.9	WATER YES WATER OK

Duration: 1 minute and 11 seconds.

Conclusion. The way in which the chimpanzees currently use their own name sign can well be interpreted as a routine, or as a wild card sign that they can throw in when the human does not immediately fulfil their request. They also use their own name sign as a sort of obligatory answer to a question that the human asks. Their own name sign figures in responses to WHO questions, but also to WHAT or WHERE questions. In these instances the name sign use also follows a delay in fulfillment of requests caused by the human questions. The use of name signs in multiple-sign utterances strengthens their interpretation as wild cards.

6. Summary of the main results.

The following are the main results on the chimpanzee signing behaviour in the four corpora:

- Requests for objects and actions predominate the chimpanzees' communicative intentions when making signed utterances.
- Signs for objects and actions, request markers, and wild card signs are the most frequently made signs.
- Several signs are made very frequently: Ten signs account for 60% of the times a sign is made.
- Imitation of a human sign occurs in 20% of the times a sign is made. Full imitations and reductions take up 18% of the total of utterances. In 11% the utterances are expansions.
- The majority of the chimpanzee utterances consist of 1-sign utterances.
- There is no clear evidence for semantic relations in two-sign combinations.
- Multiple-sign utterances contain frequent repetition of signs, redundant signs, strings of multiple object and action signs, and wild card signs such as the chimpanzee's own name sign, and the signs THAT/THERE/YOU and GOOD.
- A nonsyntactic order pattern exists in two- and three-sign combinations: Object and action signs are used more frequently in the initial position of an utterance, while request

markers, the chimpanzee's own name sign and THAT/THERE/YOU and GOOD occur more frequently in the final position of an utterance.

- The use by the chimpanzees of their own name sign suggests that these function as wild cards to speed up the fulfillment of requests.

In the first part of the next chapter, the Discussion, the results are summarized again and these conclusions are then examined in more detail.

CHAPTER 5 DISCUSSION

In this last chapter the results of the study on the recent signing behaviour of the chimpanzees will be discussed. In Part I the main findings will be summarized and related to the debate in the ape language controversy. An attempt will also be made to compare the recent signing in the four corpora to the earlier signing of the same chimpanzees. The different subject matters will be discussed in the following order. First, the individual signs used in the recent corpora will be examined and related to the earlier official vocabularies of signs. This will be followed by a discussion of the recent combinations of signs in the corpora, with their most important characteristic of absence of structure. Subsequently, the discourse properties of the interactions will be reviewed. In the discussion on the communicative intentions the predominance of requests in the recent corpora will be analyzed. Attention will also be given to the types of communicative intentions that were absent in these recent utterances. The language question will also be discussed. This part of the chapter will end with some reflections on the chimpanzees' reported earlier signing in the light of the findings of this study on their recent sign use. In Part II the issue will be discussed whether the signs that the chimpanzees acquired can best be interpreted as symbols, or whether the evidence does not allow for an interpretation that goes beyond the stimulus-response associative level. In Part III the use of lexigrams by the pygmy chimpanzee Kanzi will be presented and compared with the recent sign use of the chimpanzees in the four corpora. This Discussion chapter will close with Part IV, which contains suggestions for future research.

PART I. THE RESULTS AND THEIR INTERPRETATION.

SIGNS

Skewed use of signs in vocabulary and wild card signs.

The group of five chimpanzees used 88 different signs in the 22 hours of videotaped conversations with human companions from the four recent corpora. Individually, the chimpanzees used a mean of 39 different signs, with a range going from 4 signs (Loulis' total) to 55 for Moja and 54 for Tatu. This number of signs is a limited part of their official vocabulary. It is about a third of their reliable vocabulary, with a range going from 23% for Washoe to 40% for Loulis (4 signs of his reliable vocabulary numbering 10 signs).

The 10 most frequently used signs by the five chimpanzees combined were THAT/THERE/YOU, COME/GIMME, DRINK, FLOWER, FOOD/EAT, SMELL, GUM, TOOTHBRUSH, BRUSH, and HURRY. These 10 signs were used that frequently by the chimpanzees that they accounted for 60% of the times a sign was made. Interesting too is that each individual chimpanzee used particular signs in percentages of 10 or more of the times that they made a sign. Moja's most frequent sign BRUSH accounted for 9% of her total sign use. Tatu had three such signs: BLACK, taking up 11%, and DRINK and YOU both amounting to 9%. Dar's most frequent sign, his own name sign DAR, accounted for 13% of the times that he made a sign. With Washoe this situation is more extreme. In almost half of the times that she produced a sign she used one of three signs: COME/GIMME (26% of her total), FLOWER (12%), and GUM (11%). Lastly, Loulis' production of signs is altogether different. With him three signs accounted for up to 95% of the times that he made a sign: THAT (56%), GIMME (26%), and CHASE (13%).

When one looks at the division of the recently used signs within the official system of semantic categories set up by the Gardners, one sees a similar limited picture. Object signs took up 31% of the combined total, with signs for edibles being the largest category of all, 21% of the total. Object/actions were the case in 17% of the times, represented largely by FOOD/EAT and DRINK. Request signs accounted for 15%. Person signs, made up almost exclusively of YOU and the chimpanzee's own name sign, accounted for 11%. Action signs such as SMELL, CHASE, and PEEKABOO, were made in 8% of the total. The sign called Demonstrative, THAT, also accounted for 8%, but this sign may have changed from semantic category to something more of a request marker. Attributes were made in 6%, and were taken up largely by Tatu's unclear BLACK (3%), Moja's RED, and Washoe's HOT (which functioned more as an object sign for a drink). Locatives consisted mainly of pointing glossed as THERE and several INs and OUTs that might be interpreted as action signs rather than references to locations. The sign GOOD was the only Trait sign. It accounted for 1% and was usually part of request utterances. Lastly, there were four times that Moja shook her head sideways that were transcribed as NO, officially part of the Negatives category. However, it was unclear whether Moja was actually expressing *no* in these instances.

This summary shows that the sign use in the four recent corpora is limited to object and action signs, together with request markers and wild card signs (THAT/THERE/YOU, the chimpanzee's own name sign, and GOOD) that function to add emphasis or to please the humans in order to get requests fulfilled. There is very little use of other semantic categories.

How does this recent sign use compare with the chimpanzees' reported vocabularies and earlier sign use? In Table 5.1 a comparison is made of the semantic categories of the signs of the early days as presented by the Gardners, with those found in the study on the recent sign use of the chimpanzees.

Table 5.1 Comparison of semantic categories of the early sign use with those of the recent sign use in the four corpora.

Semantic category	Early #	Recent #	Early Signs	Recent Signs Corpora
Names, chimpanzees	4	4	DAR, MOJA, TATU, WASHOE	DAR, MOJA, TATU, WASHOE
Names, humans	31	2	NAOMI, SUSAN, ROGER, B.T.G., R.A.G., TOM, etc.	HEIDI(?), ROGER(?)
Names, generic	3	1	BOY, FRIEND, GIRL	BOY
Pronouns	3	2	ME, WE, YOU	YOU, ME
Objects, animates	9	4	BABY, BEAR, BIRD, BUG, CAT, DOG, HORSE etc.	BIRD, DOG, CAT, COW
Objects, edibles	29	30	APPLE, BANANA, BERRY, CANDY, COOKIE, GUM, ICE, MEAT, NUT, ONION, PEACH, SANDWICH, SODAPOP, TOMATO, WATER etc.	FLOWER, GUM, COFFEE, CHEESE, NUT, WATER, CRACKER, MEAT, ICE, GRASS, BANANA, FRUIT, etc.
Objects, inanimates	49	13	AIRPLANE, BALL, BOOK, CLOTHES, EARRING, FLOOR, GARBAGE, HAMMER, HURT, KEY, MIRROR, PANTS, RING, SHIRT, SHOE, TABLE, TOOTHPASTE, etc.	TOOTHBRUSH, CLOTHES, SHOE, BOOK, LIPSTICK, HAIR, MASK, BLANKET, HAT, KEY, WRISTWATCH, COVER, HURT
Objects/Actions	29	10	BATH, BRUSH, CAR, COMB, DRINK, FOOD/EAT, HANKY, HEAR/LISTEN, LIGHT, PEEKABOO/MASK, RIDE, SCHOOL, etc.	DRINK, FOOD/EAT, BRUSH, FLOWER/SMELL, DIRTY, OIL, LIGHT, SEE, COMB, HEAR/LISTEN
Actions	18	9	BITE, CATCH, GO, HUG, KISS, LAUGH, OPEN, etc.	SMELL, CHASE, PEEKABOO, etc.
Locatives	6	3	DOWN, HOME, IN, OUT, THERE, UP	THERE, IN, OUT
Demonstratives	1	1	THAT	THAT
Attributes, colours	5	2	BLACK, GREEN, ORANGE, RED, WHITE	BLACK, RED
Attributes, possessives	2	--	MINE, YOURS	
Attributes, materials	3	--	GLASS, METAL, WOOD	
Attributes, numericals	2	--	ONE, TWO	
Attributes, comparatives	4	--	BIG, DIFFERENT, SAME, SMALL	
Attributes, qualities	3	2	HOT, SOUR, SWEET	HOT, SWEET
Negatives	4	1	CAN'T, ENOUGH, FINISH, NO	NO(?)
Traits	3	1	FUNNY, GOOD, SORRY	GOOD
Markers	13	5	AGAIN, COME/GIMME, HELP, HURRY, MORE, TIME, WANT, WHO, etc	COME/GIMME, HURRY, TIME, PLEASE, MORE
Total	219	90		

The data on the semantic categories in the early sign use by the chimpanzees are based on information given in Tables 3.1 and 3.2 of Gardner, Gardner, and Nichols (1989) and Table 1

of Gardner and Gardner (1994a). The signs within the Recent signs corpora category (last column) are presented from most frequent to least frequent. This presentation could not be applied to the Early signs category, because there were no frequency data available on these signs. The early signs are presented alphabetically. The sign THAT/THERE/YOU was counted three times in both the early and recent sign use, as a demonstrative (THAT), a locative (THERE), and a pronoun (YOU) respectively. The sign TOOTHPASTE was categorised in the recent sign use in the four corpora as an object sign for an edible rather than an inanimate object, because the sign figured in requests for more edible toothpaste on toothbrushes. See section 4.3.3.2. for further explanations of the division of recent signs to semantic categories. The recently used sign PERSON was not included in this table, as it was not classified for semantic category by the Gardners.

These are the main differences that come up when looking at Table 5.1. The semantic categories edibles, inanimates, object/actions and actions, are of comparative size. This is especially the case with the signs for edibles: almost all these signs reported for the early period are still used in recent times. However, in the inanimate and animate object categories, far fewer signs were used in the recent corpora. The chimpanzees restricted their use of name signs to basically their own name sign only. The category locatives and colour terms also have reduced. Though present in the early days, there was no use of signs for possessives, materials, quantitatives and comparatives in the recent corpora. Many markers and most traits did not show up in the recently analyzed material either. There is thus somewhat of a contrast between the chimpanzees' signs in the recent corpora and their reported signs in earlier times. In the early days their vocabularies seem to have been much larger, and the chimpanzees seem to have shown a more varied use as well, in terms of having a larger variety of semantic categories that were used. One should keep in mind though that the chimpanzees may still use signs from their vocabularies that were not part of the utterances in the recent corpora.

Future studies may find additions to the recent findings. However, the frequently used categories and those that were absent may indicate their general recent use of semantic categories.

When the chimpanzees' recent signs in the corpora are compared with the signs used by Nim the similarities are bigger. Object and action signs, as well as request markers, also figured largely in Nim's vocabulary. Differences are that Nim had quite a few name signs for his human companions as well as trait signs that none of the chimpanzees showed in the recent corpora. Also, because frequency data have been provided on Nim's signs, his most frequent signs can be compared with those in the recent corpora of the CHCI chimpanzees. A big similarity then results: A large proportion of sign use is covered by only a small set of signs. Only 7 signs accounted for almost half of the times that Nim used a sign (see section 2.1.5.), while 10 signs covered 60% of the chimpanzees' recent sign use. In both cases there is thus a skewed application of the signs in the vocabulary. A small set of signs occurs disproportionately frequently, while the other signs in the vocabulary show up only incidentally or not at all. The contents of these most frequent signs are also similar. Nim's most frequent signs were NIM, ME, YOU, EAT, DRINK, MORE and GIVE. Four of these signs are also among the 10 most frequent signs of the five CHCI chimpanzees in the four recent corpora: THAT/THERE/YOU, COME/GIMME, FOOD/EAT and DRINK. All of Nim's and the five chimpanzees' most frequent signs express desired objects and actions, or function as request markers and manipulators of the humans. Terrace and his colleagues called the frequent signs *wild cards*, because they were very useful and almost always appropriate in any context. The same is true to some extent of the five chimpanzees' recent most frequent signs in the four analyzed corpora. Four of these signs, though, in particular GUM, TOOTHBRUSH, BRUSH, and SMELL, may refer more to the objects or actions that the chimpanzees most desire. It is known in the CHCI that gum and toothbrushes (with usually some edible toothpaste on them) are amongst the favourite treats of the chimpanzees.

The action of brushing the chimpanzee's body and the breath-smelling interaction initiated by SMELL are some of the favourite activities the chimpanzees like to receive from the humans. Then again, the structureless stringing of these four signs in multiple-sign utterances may suggest a possibility that these signs sometimes also function as wild cards.

The chimpanzees' own name signs also appear to function as wild card signs. Most of the times a name sign was made in the recent signing in the four corpora, it was produced after a human Wh-question. Often this was WHO, but it is important to take notice of the fact that in some cases the chimpanzees made their name sign when the human asked questions such as WHERE DRINK or WHAT. When the chimpanzees signed their own name sign spontaneously (i.e., without a preceding human question) they were making request utterances and the name sign appeared to have been added in order to have the human fulfill the request more quickly.[347] Other recently used signs that have a wild card nature are GOOD and HUG. It is important to recall that in their 1971 publication the Gardners had interpreted Washoe's use of name signs and pronouns in the same way. Though they don't mention the words "wild card," they describe their use as routine signs that are useful to add in order to please and manipulate the humans (see section 2.2.4.1.).

Wild cards are thus signs which have demonstrated their usefulness in past interactions with humans. When the chimpanzees use them they may not be communicating the symbolic meaning of these signs. Instead, they produce them in a more pragmatic, instrumental way, with the expectation of a cooperative effect on the humans.

[347] Savage-Rumbaugh (1981) mentioned a similar use of the name lexigrams of humans by Sherman and Austin. She pointed out that there was no evidence that these were used in a referential sense. They may have been of a performative nature only, the apes knowing when to use these lexigrams in a general way to achieve desired actions or rewards.

Implications of the recent use of certain signs.

The results of this study also have implications for four specific individual signs: YOU, THAT, COME/GIMME, and HURRY.

YOU. In the recent corpora YOU was a frequent sign, particularly in action requests, where it was sometimes combined with the action the chimpanzee apparently wanted the human to perform. It is important to keep in mind here that the pointing signs YOU and ME had originally been taught in the context of turn-taking in games, rather than in simple descriptions of persons (Terrace, 1979a). Gardner, Gardner, and Nichols (1989) described the use of YOU as activity-related. It referred to "the addressee during food-sharing, games with turns such as tickle and hide and other activities" (p. 67). Thus, in the teaching stage as well as in the recent sign use in the four corpora, the sign YOU is strongly directed to have control over the current action. Its use can be seen as a manipulation of the direct physical and social reality. This further detracts from the likelihood of seeing signs such as YOU and ME as actual pronouns.

THAT. The recent use of THAT in the four corpora suggests that this sign may have shifted in semantic category. Having been categorized as a demonstrative by the Gardners, it now was part of many request utterances where it appeared to function as an indicative request marker. This accords well with the characterization by Bates and her colleagues of early pointing in children as a proto-declarative but also as a proto-imperative (Bates, Camaioni & Volterra, 1975; Bates, Benigni, Bretherton, Camaioni & Volterra, 1979).[348]

The use of THAT in the filmed private signing studies may still suggest that THAT is also used as a demonstrative. In the second study on this subject THAT was the most frequent sign that was privately produced: 150 times. The majority of these, 125, were by Tatu. The utterance type that was most often signed in the second study also was the single

[348] Braine (1976) mentioned that his son Jonathan used a similar formula to request a specific object: *this+X*. See also the work by Laura Petitto (1987), former assistant of Project Nim, on human children's early use of pointing and its development during sign language acquisition. Fouts (1975a) mentioned the requesting use of

sign utterance THAT. It was made in 98 instances, of which Tatu was responsible for 85. THAT also was part of frequent combinations of signs, 42 in total. Tatu made 30 of these, her THAT MILK (7), THAT BLACK (5) and THAT BLACK THAT (5) utterances were the most frequent combinations in that study. She also combined THAT with further object signs: FLOWER, APPLE, POPCORN, and ICE CREAM. Washoe (7 instances) and Moja (5) also combined THAT, usually with an object sign. It has also been documented that while looking at magazines or picturebooks, the chimpanzees sometimes put their pointed index on a picture (Krause & Fouts, 1997). This use of THAT can not be considered as uttering a request, because the utterances were not directed to another person. It is maybe this private use where THAT is used as a demonstrative. The Gardners' categorization of THAT as only a demonstrative, however, is no longer justified in the description of the chimpanzees' recent signing in the analyzed corpora.

COME/GIMME and *HURRY*. A point from the earlier discussion in chapter 3 returned in the results of this study. This is the question of natural chimpanzee gestures inflating the subjects' sign use (discussed in 3.4.). In the recent corpora the three signs COME/GIMME, HURRY and OPEN occurred in the following frequencies. COME/GIMME was made 459 times and HURRY 159 times (OPEN was not observed). Both were among the 10 most frequent signs. Together these two signs took up 12.9 percent or an eighth of the total. Should one interpret them as natural gestures rather than acquired signs, the totals of signs used and instances of signs would be 86 signs used in 4,158 times. Thus, a decrease of 618 instances.

The way Washoe often signed COME/GIMME in the recent corpora was somewhat different from the official Gardners' PCM description. In all four corpora rather than making beckoning movements with a whole hand, Washoe often put one finger (usually her little finger) through the bars of her enclosure, and then wiggled with it in the same manner as is

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pointing by a gorilla: "Schenkel (1964) has reported that a young female gorilla communicated her wants to her keepers by pointing. For example, to request that the door be opened, she put her finger to a key hole" (p. 139).

normally done with the whole hand. Jensvold glossed Washoe's variation of GIMME as GIMMIE, as it was often only made with her little finger, or pinkie. It has not been observed how this change came about. One can imagine that it is a result from the captive condition and the barred enclosures the chimpanzees have been in since Oklahoma and especially since their move to Ellensburg. It may therefore be an idiosyncratic innovation caused by environmental changes. GIMMIE has been interpreted as a modified sign but it may also be a modification of the natural beckoning gesture.

Identification errors and sloppy signing.

The examples of perception errors between signs that are close in PCM that were mentioned in chapter 3.1. occurred several times in the corpora of the chimpanzees' recent sign use. For example, transcribers had sometimes transcribed Washoe's WASHOE as an instance of the ROGER sign. Having a permanent record in the form of videotape made it possible to assess the occurrence of such errors of perception or identification. Re-identification by an independent transcriber often resulted in the sign being reinterpreted as WASHOE. Note that errors in perception can also occur when analyzing permanent records. However, they can be remedied precisely because one has a permanent record within which one can go back to the exact time on the video that the behaviour took place

A note should be made here about the validity of the signs that were reliably transcribed in this study. First of all, the chimpanzees were not always clearly differentiating between signs. Sloppiness was sometimes the case. For example, there were several transcriptions where Moja had apparently signed SWEET in between a bout of many REDs. These signs are close to each other in PCM. RED is made by rubbing the index down from the lips. The chimpanzees' SWEET is done by contacting or rubbing the fingertips or an open hand down from the lips. One can imagine that repeating the sign RED in a fast and hurried fashion can lead to a "slip of the hand" in the form of SWEET. Transcribers in this study only

focused on the presence of the PCM and did not make further interpretations on the aptness or meaning of the signs that they found. This ensured a transcription that was more interpretation-free and decontextualized. However, this procedure may also have led to a situation where certain signs entered the transcriptions that in reality may have been sloppy versions of another sign, as in the case of SWEET and RED. Other signs in the transcriptions were less clearly probable sloppy versions of another sign. Not all sloppiness could be detected by signs like SWEET neatly shut in between lots of REDs. Sometimes a sign was made only once, so it was less apparent that it could have been a "slip of the hand."

Furthermore, in some instances a sign was made and the PCM of the sign was clearly there, but contextually the sign did not appear to make any sense. The chimpanzee may not have meant to express something approaching the sign's given gloss. It may also have been the case that the chimpanzee was intending to use another sign and mistakenly made another one. Examples of rare signs that did not fit the context in this study were CRY, HEAR/LISTEN and HURT.

One should therefore look at the signs that were found in this study with a certain caution. In general, one can say that the more frequent a sign was found, the more probable it was actually made, that is, the more probable the chimpanzee meant to use that particular sign. There is thus no problem with frequent signs such as DRINK, FLOWER, GUM, and TOOTHBRUSH. Signs that were used only once or twice, however, are more doubtful.

COMBINATIONS

Lack of semantic and grammatical structure in sign sequences.

The following results were obtained on the chimpanzees' combinations of signs in the four recent corpora. Only 33% of the chimpanzee utterances consisted of combining two or more signs. Within two-sign combinations no evidence was found for the expression of semantic

relations. The only clear types of combinations were sequences in which object or action signs were combined with a request marker, with a point at the human, or with a point to the location of the desired object or action. Multiple-sign utterances of three or more signs did not provide more information than shorter utterances. Many of these longer combinations consisted of repetition of several signs or of adding redundant signs, such as the chimpanzee's own name sign and request markers to an utterance that was already a request. The signs THAT/THERE/YOU and GOOD were also often part of multiple-sign combinations, functioning to add emphasis or to pressure the humans into action. Sometimes the longer utterances were strings of wild cards or maybe multiple request items with repetition of certain signs to add emphasis to the request. The fact that the multiple-sign utterances all had the same characteristics and frequent signs means that there was a large degree of overlap between the different lengths of utterances.

The chimpanzees had a clear pattern of order preference in two- and three-sign combinations. Object and action signs were more frequent in the initial position of an utterance, whereas request markers and the signs THAT/THERE/YOU and GOOD appeared most frequently in final position. However, this order preference cannot be considered evidence for syntactic rules. It fits very well with an acquisitive motivation. The object and action signs can be seen as the most salient signs of the chimpanzees' signs, because these are the items that the chimpanzees request. The request markers and the signs THAT/THERE/YOU and GOOD function to add emphasis to the request or to spur the human into action to fulfill the request.

In conclusion then, there was no apparent semantic and grammatical structure to the chimpanzees' recent combinations in the analyzed corpora. The Gardners and Fouts have reported substantially different results for the chimpanzees' earlier combinations. According to them, the chimpanzees quickly started to meaningfully and even grammatically combine the signs within their vocabulary. Semantic relations were present in 74 to 90% of their two-

sign combinations. Novel meaningful combinations were used in a spontaneous, creative manner by the chimpanzees to describe objects and events for which they had not yet learned a sign. Some regularities in sign order were present, and the chimpanzees used typical ASL forms of grammar in the form of the different types of sign inflections. Multiple-sign combinations provided more information. The main difference between the reported earlier combinations of signs and those in the recent corpora, then, is a lack of structure in the recent sign sequences, while their early combinations appeared to have shown considerable meaningful structure, comparable to the structuredness of children's early combinations.

As with the individual signs, the recent combinations from the analyzed corpora, in contrast, show a strong similarity with Nim's signing behaviour. In Nim's combinations no evidence could be found for the presence of semantic and grammatical rules for the combination of signs. Instead, other patterns were discovered that accounted for his strings of signs. The use of wild card signs was present in many of his combinations, suggesting a strategy on Nim's part of signing more only to manipulate the humans in fulfilling his acquisitive interests. Repetition and redundancy also accounted for a great deal of Nim's multiple-sign combinations. These exact same patterns and phenomena were found in the five chimpanzees' sign combinations in the four recent corpora.

The way in which the chimpanzees recently combined their own name sign and the sign YOU with other signs gives further confirmation of an interpretation of these signs as wild card signs. Rather than these combinations expressing semantic relations, the chimpanzees may well add these signs because they are considered correct and appropriate by the humans in most contexts. Thus, they are wild card signs that the chimpanzees have learned to use often, because they functioned well in their interaction with the humans.

Responses to Wh-questions without apparent understanding.

The chimpanzees' responses to Wh-questions in the recent corpora may not demonstrate an understanding of the different Wh-signs and a knowledge that these require one specific semantic category as an answer. Several routines were found here. When the human asked a question with WHO, the chimpanzee usually responded with his or her own name sign. The chimpanzees' responses to WHERE sometimes showed the locative sign THERE, but not always. Sometimes they replied here with their own name sign, giving the impression that they do not understand the sign WHERE. Taking all of their responses into account, all that is necessary to explain their responses to Wh-questions in the recent corpora is some sort of rule or strategy the chimpanzees have that whenever WHO or WHERE is made, they should make their own name sign and they will get what they want. Future study of chimpanzee responses to Wh-questions should further analyze this particular type of signing behaviour.

DISCOURSE

Manipulative rather than conversationally appropriate.

Imitation of human signs took place in the chimpanzee signing in the recent corpora in a percentage of 20% of all the times a sign was used. Four out of five signs were thus made spontaneously. Specified for utterances, 18% of all utterances were full imitations or reductions (imitating all or only some of the human signs, without addition of novel signs). In comparison with the human children in the Bloom, Rocissano, and Hood (1976) study, the chimpanzees imitated the same amount as the children did. The children's mean percentage of imitation at Stage I was 18%. Other studies showed that imitation is not frequent in children's early language (Nelson, 1973; Frijn & De Haan, 1990).

The imitation data of the chimpanzees' sign use in the four recent corpora are different from those that Terrace found for Nim. Nim had a percentage of fully or partially

imitated utterances of 38% to 54%, which is considerably more than in the recent signing of the five chimpanzees. Terrace's characterization of chimpanzee signing as predominantly imitative and nonspontaneous therefore applies more to Nim than to the signing of all chimpanzees. In the signing of the chimpanzees in the recent corpora imitation takes place, but spontaneous signing is much more prevalent than the Terrace team concluded.

How to interpret this finding? It could mean that the recent signing is thus more similar to children's early speech and therefore more linguistic in nature. However, the other aspects of the recent signing in the four corpora do not show linguistic characteristics. It may therefore be that the spontaneous nature of the signing only means that the chimpanzees themselves consider the use of signs to be something valuable and useful in their interaction with humans. They have learned that producing signs will get them what they want.

The sign use of the chimpanzees in the recent corpora showed a lower percentage of expansions of human utterances than that of children's expansions of adult utterances. In these expansions, the chimpanzees imitate some of the human signs and then add one or more novel signs. (Note the difference with full or partial imitations, in which there are no novel signs.) In the recent signing in the four corpora the chimpanzees expanded human utterances in 11% of their utterances. Nim also did this infrequently, in 7% of his utterances. For human children, however, an expansion percentage of 21 has been reported, which increased with time (Bloom et al., 1976).

These discourse results also have implications for the conclusions of the Bodamer and Jensvold studies on conversational abilities. An important point here is the limited nature in which Bodamer and Jensvold analyzed the corpora that they collected. They looked at aspects of sign use that did not take into account the full nature of the utterances. They made no analysis of the actual contents and structure of the utterances themselves. They did therefore not know that most of the chimpanzee utterances were single sign request utterances, and that the combinations contained unrelated strings of signs to spurt the human

into action when the human did not immediately fulfill the chimpanzees' requests. This omission is an example of the serious mistakes that the behaviourist dislike of any form of interpretation can cause. The thought that one is more scientific by looking at noninterpretational aspects such as the percentage of imitation and expansion, and disregarding a comprehensive linguistic analysis of the whole corpus, in fact results in an incomplete picture of the sign use. This in its turn can lead to wrong conclusions, such as that the studied aspect of chimpanzee signing behaviour is similar to child language.

Chimpanzee expansions of their own earlier utterances. Another problem in the Jensvold study is that she interpreted the chimpanzee expansions of their own earlier utterances to be "showing a persistence in their original topic and giving the interlocutor more information" (1996, p. iii). Jensvold defined expansion as any addition of signs to the signs of an earlier response. The application of the term expansion to an utterance was then considered justified as long as there were extra signs made by the chimpanzees. However, analysis of these expansions show that these were not always providing more information, in contrast to most children's expansions. Jensvold gave a child example of expansion of a child's own previous utterance. A child says "The dog is swimming." It gets a response from an adult in the form of "Huh?" to which the child then reacts with the expansion "The dog is swimming in the water." Jensvold then presented a chimpanzee example that she interpreted to be of the nature of such informative child expansions. In a session from Tape 3 Washoe signed ME GIMMIE. Jensvold then signed NOT UNDERSTAND. Washoe replied with the expansion FOOD GIMME.

However, the chimpanzee expansions were sometimes also of a different, maybe less linguistically meaningful type. They could consist of adding another request item to the sequence, or adding a request marker, or a wild card such as their own name sign, the sign THAT/THERE/YOU, or GOOD. For example, in session 75 of Tape 3, Washoe signed FLOWER GIMMIE. Jensvold then signed NOT-UNDERSTAND. Washoe then expanded on

her previous utterance by signing FLOWER ME FLOWER GUM FLOWER GUM THAT GUM GIMMIE. In session 92 of Tape 2, Moja signed FLOWER PEEKABOO. Jensvold asked her WHO FUNNY? Moja then expanded her previous utterance with FLOWER YOU SODA GOOD. A last example comes from session 67 of Tape 1. Tatu signed SMELL, to which Jensvold reacted with NOT-UNDERSTAND. Tatu then made the following expansion: MEAT SMELL.

The chimpanzees thus sometimes expand their utterances by adding new object and action signs. Because their earlier (usually request) utterance did not get fulfilled by the human, they may then string object and action signs in the expectation that one of these will make the human give the chimpanzee something at last. These types of expansions may then be an effect of the human delay in fulfillment of requests caused by the questions and other intermittent human utterances.

Routine question-answer interactions.

In the recent discourse between the humans and the chimpanzees in the analyzed corpora the routine asking of questions throughout the daily interactions and activities was still strongly present. This was particularly the case in the *1993* and *1994* corpora. Of course this was part of the structure of the experimental design of these studies. Though an analysis has not been done of the amount of these routine questions, it seems that the relaxed conversations of the *1999* corpus contained a smaller number of routine questions.

Also, what may be apparent in the conversations between the humans and the chimpanzees in the recent corpora, is that the humans want or expect the chimpanzees to sign about more than just requests. The humans ask many questions in the expectation that the chimpanzees will answer these with relevant information. Thus, an element of demand from the humans to sign may still be discernible.

The chimpanzees themselves, besides finding the signs useful for their acquisitive interests, may have noticed that their interaction with humans can well take place without having to use signs. In the eight years in which the four corpora of the present study were collected (1992-1999), though ASL was maintained as an important medium of communication within the CHCI, much or most of the communication among the humans was done in English rather than sign language. In the 5 years and 4 months that Project Loulis lasted (March 1979 to June 1984) the humans only talked when Loulis was present, leaving the chimpanzees as the only ones to use signs at such moments. This situation has probably had an impact on the status of the sign use in the chimpanzee-human interactions. It may have made clear to the chimpanzees that, besides using signs to utter their requests, the communication between the two species can well be fruitful without using signs. It may therefore be that in the later years the status of sign communication will have been considered to be important specifically by the humans. The humans want the chimpanzees to use signs. This situation may have increased the chimpanzees' proclivity to produce signs beyond their requests only to please the humans.[349] The chimpanzees may have grasped that it is not necessary to use signs to communicate information, but instead that signing is demanded from them to please the humans, which will then have led to the manipulation of humans, chimpanzees being the intelligent animals that they are. Such a more extrinsic, manipulative motivation of the chimpanzees' sign use has all the more likely been strengthened when one considers the following aspects of the chimpanzee-human interaction in the recent corpora: the many signed questions that they get asked every day, combined with lots of nonverbal cues from the humans that show that they await the apes to be signing back to them (looking at them attentively, holding eye contact, not giving any further response), and even the fact

[349] Of relevance here is a remark by the Gardners about the function and pervasiveness of "ASL only" (using only ASL when communicating with Washoe, rather than also exposing her to spoken English) in Project Washoe: "Signing to the infant chimpanzee and speaking English among themselves [by the humans] would also have been inappropriate. That would have lowered the status of signs to something suitable for nursery talk, only" (1989a, p. 6). In 1969 they already mentioned this: "We reasoned that this would make it seem that big chimps talk and only little chimps sign, which might give signing an undesirable social status" (p. 666).

that the humans sometimes withhold an object or the execution of an action until the chimpanzee explicitly uses signs for it or responds to a human question. In conclusion, there is somewhat of a dual monologue in the sign interactions between the humans and the chimpanzees. The humans ask specific questions and sign about a wide variety of different subjects, while the chimpanzees do not react conversationally appropriately to the human communications, but mainly express requests for objects and actions they are interested in.

Successive or immediate repetition of a sign.

Many signs were immediately or successively repeated in the recent corpora. A precise number does not exist, since the study did not analyze this phenomenon. It is definitely a worthwhile subject for future analysis. Besides its frequent occurrence, signs were sometimes reiterated nonstop for several seconds. Just like the nonimmediate repetition of a sign in multiple-sign utterances, the apparent function was to add emphasis to the utterance. The communicative intention of the multiple-sign utterances with repeated signs were requests for objects or actions. A future analysis of immediate repetition of the same sign could similarly show that this occurs especially when the chimpanzees are making requests, which is the impression one gets now. Also, it may be that successive repetition of a sign is related to a delay in desired reaction by the human.

COMMUNICATIVE INTENTIONS

Predominance of requests for objects and actions.

The communicative intentions of the chimpanzees when using the signs in their interactions with humans in the recent corpora, predominantly consisted of requests. Present in 87% of all sign utterances, with a percentage range of 63 to 96 in the different corpora, requests were the underlying motive in the vast majority of the chimpanzees' recent sign utterances. The

chimpanzees requested both objects as well as actions from the humans. However, requests for objects were more than three times as prevalent than requests for actions. Naming or labeling of objects and pictures was also part of the chimpanzees' intentional repertoire, though in only 2% of the total. The only other category of communicative intentions present was Answering, consisting of responses to human questions (4% of total). In these particular utterances, the chimpanzees were often giving their own name sign after the human had asked a Wh-question with an interrogative sign such as WHO?

The predominant reason why the chimpanzees used signs in the recent corpora then, was to request things from the humans. They asked for objects to eat or drink, such as the plants that grow on the berm, gum, coffee, cheese, nuts, and water. Nonedible objects were also requested, to play with or manipulate. Amongst these were clothes, shoes, books and lipstick. Tatu asked for masks in this category, which is a preferred object of hers.[350] A special example was the chimpanzees' request for TOOTHBRUSH. Though asking for a nonedible object, the routine in the institute was that the humans then gave them a toothbrush with some toothpaste on it, which the chimpanzees enjoy to eat. Actions were also requested from the humans. The actions they asked for were chase and peekaboo games, brushing from the human, and the specific routine requested by the sign SMELL, in which the humans blow their breath to the chimpanzee so that the chimpanzee can smell the humans' breath.

The captive situation of the chimpanzees will have played a part in this predominance of requests. The fact that they are incarcerated and are fully dependent on the humans to bring them foods, objects, and enjoyable activities to which they have no access, causes them to utter requests whenever they want something.[351] They can not provide themselves with foods and drinks. They cannot go to the kitchen to provide themselves with edibles (indeed,

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[350] In the study on responses after (announcements of) events, Gardner, Gardner, and Drumm (1989) mentioned that Tatu often played with Halloween masks. Masks were rated as a very positive event for Tatu by the humans in this study.

[351] In a study with human children Coggins, Olswang, and Guthrie (1987) found that requests were few when there was a low structured situation, where objects were easily accessible and mothers generally followed their child's lead.

they can never get outside of their enclosures). They have to eat the meals the humans serve them at the regular meal times during the day, or they have to manipulate the humans into giving them something else. A similar situation is the case with toys and other objects. The humans lay out various kinds of objects such as toys for the chimpanzees to play with and manipulate before they enter their indoor rooms and outdoor area during the morning or afternoon. However, should they want some other particular toy or object, they cannot go into the room where toys and other objects are kept. Again, they have to ask the humans.

Nevertheless, the fact remains that the chimpanzees had almost no other communicative intentions in the thousands of utterances that were analyzed. This suggests that the predominance of requests indicates their general motivation in using signs. Being held captive and having no access to most things, is an obvious factor in the frequency with which the chimpanzees utter requests. However, they might well have communicated all kinds of other intentions as well.

A remark should be made here about the fact that in both the *1993* and the *1994* corpus the human interlocutor purposefully tried to evoke requests from the chimpanzees in order to elicit their signing (so it could be analyzed for the particular research questions of these respective studies). Bodamer sometimes kept coffee or a soda close to his desk, so that the chimpanzees could see it. Jensvold sometimes went to the chimpanzee enclosures carrying toothbrushes, lotion, or plants from the berm, in order to evoke the chimpanzees' signing. Also, in the *1994* corpus a picturebook (a good condition for naming as evident from the *1992* conversations) was present only a few times, while it was absent in the analyzed *1993* conversations. However, though this may account for a larger percentage of requests and a smaller percentage of naming utterances in the *1993* and *1994* corpus, the pattern of communicative intentions in the other corpora is the same. Requests were dominant in all four corpora, and the other intentions present are naming and answering. Furthermore, the chimpanzees were not forced to request in the *1993* and *1994* corpora. They were free to

express any intention they had at the moment in the conversations. The fact that they nevertheless predominantly requested, shows that this can be considered representative for their daily interactions with humans.

Specificity of requests.

Terrace (1985a) has said that the signing chimpanzees were not really specific when they made requests, but rather produced a variety of signs until they obtained the object or activity they wanted from the human: "Thus, a banana could evoke the signs EAT, NIM, ME, or BANANA, along with many irrelevant signs" (p. 1023). Seidenberg (1986) also mentions this lack of specificity in Nim's signing. This characterization seems to fit the chimpanzees' way of requesting in the recent corpora well. The analyzed conversations show that the chimpanzees will produce many different signs, some more relevant than others, in order to manipulate the human into fulfilling their request. This is also evident in the combinations and multiple-sign utterances that they make. The meaninglessly appearing concatenation of signs, together with the throwing in of wild cards such as their own name sign and signs such as YOU, THAT, and GOOD, are all evidence of inundating the humans with signs until these get into action to give them something. Indeed, the steady production of apparently structureless strings of varied signs in order to obtain desired objects or actions also shows itself when the *1993* sessions are compared with the *1999* sessions. In the *1999* sessions the humans were not required to first go through a series of questions or statements before they fulfilled a chimpanzee request. Usually, the humans then fulfilled the chimpanzee's needs after one or two utterances by the chimpanzee. In the *1993* sessions, however, because of their experimental and somewhat structured nature on the human side, the chimpanzees had to make quite a few utterances and respond to a bunch of human questions and remarks, before the human finally gave the chimpanzees what they wanted. The larger proportion of multiple-sign utterances in the *1993* sessions may have been caused by frustration on the

chimpanzees' part, when they were not immediately served. This element of frustration was sometimes apparent not only in the longer and stringlike utterances they made in these sessions, but also in their nonverbal behaviour. The chimpanzees sometimes got aroused and showed natural impatience behaviours such as swaying with their body and shaking their hands up and down.

This is not to say that the chimpanzees never use correct signs, specific to the objects or activities they want. They can well produce TOOTHBRUSH when there is a toothbrush in sight that they might want, or ask for FLOWER when they are on the berm with its edible plants. And as was just pointed out, when initial requests such as these get attended to by the human relatively immediately (as in the *1999* sessions), the chimpanzee will not continue with stringlike concatenations of signs. It seems like the less specific strings of requests and thrown in wild cards are not the chimpanzees' usual way of communicating with humans. However, these readily appear when the human does not immediately acknowledge and fulfil the chimpanzees' request, and delays delivering the requested items by first asking them questions. So the lesser specificity seems to be a function of frustration, caused amongst other things by the human questions, rather than a characteristic feature of their general signing. Future research could try to focus on this aspect of the current chimpanzees' signing. Comparing the nature of signed request utterances when they get attended to immediately versus after a prolonged human questionnaire, might confirm this impression.

A further characterization by Terrace of the apes' signing may not be wholly correct, when looking at the recent sign data. Also in the 1985a article, he stated that "signed requests are usually not spontaneous but have to be evoked by the trainer, who first has to show the ape that a particular incentive is available" (p. 1023). The conversations in the recent corpora contained many instances in which the human was not showing the chimpanzee any incentive, and yet the chimpanzee asked for one or the other object or activity. Though detailed analyses of this particular aspect of the conversations have not been carried out, it

appears that the chimpanzees usually ask for the things in sight, such as the plants on the berm, the objects a human is carrying, or the objects on the shelves in the playroom of the old building. It is not the case, however, that the human typically has to draw attention to these objects before the chimpanzee starts signing about or for them. It is rather the other way around: the chimpanzee usually draws attention to some object to which the human then reacts. Furthermore, all *1993* sessions started off with the chimpanzee initiating the interaction by drawing the attention from a human who was busy doing something else. After having gotten the attention from the human, the chimpanzees then immediately asked for something, without the human having been able to show any incentive (though the chimpanzees may have asked for things that were in sight). So in this aspect of chimpanzee signing, Terrace's characterization appears to be incorrect. It is interesting that Terrace himself claimed in 1979a that Nim made many requests for objects or actions while the item signed about was not present, let alone being held up or shown by the human: "He might sign EAT BANANA when no banana was in sight; requests such as HAND CREAM, TEA, DRINK, APPLE, and CAT also occurred without the desired object in sight" (p. 163). In the recent signing of the chimpanzees in the four corpora many requests for objects or actions that were not in sight were made. This may be interpreted as some sort of evidence for the presence of displacement in their signing, that is, signing about things not present. In Part II of this chapter on the possibly symbolic nature of the signs, the presence of displacement in ape signing will be discussed.

The Naming instances.

In chapter 2.4. a possible difference between children and apes with regards to naming was mentioned. According to Terrace children have an intrinsic motivation in naming and using language for its own sake. The recent signing data show that naming takes place in the signing chimpanzees. However, one has to admit that it is relatively rare. There were 53

instances in the four analyzed corpora, which accounted for a small percentage of 2 (of a total of 2,839 utterances). Acquisitively communicating requests for objects and actions, is indeed a far better characterization of the chimpanzees' sign use in the recent corpora.

It is interesting to look a little closer at the recent instances of naming. All of the naming instances in the *1992* corpus (in which 43 of the 53 naming utterances were made) occurred after the human companion had started a naming session and had just asked the chimpanzee questions such as WHAT THAT? or pointed to a picture or an object. With the naming utterances in the *1994* and *1999* corpora (there were none in *1993*), the same situation existed: the human was already drawing the chimpanzee into a naming session. All these instances may therefore not be considered evidence for a spontaneous interest of the chimpanzees in naming. This situation may be different, however, in the case of Tatu. There were two instances in which she was coded to name the colour of an object, without the human asking her to do so. These instances give the impression that Tatu also enjoys naming for the sake of it and that she is similar to a human child in that aspect of her sign use. Her general behaviour during naming sessions also gives the impression that she enjoys participating in naming pictures in a picturebook or in naming objects that are laid out. However, this may only be an impression and one could conjure up different explanations for her seeming interest in naming. For example, rather than being interested in naming itself, she might only demonstrate naming behaviour in the expectation of getting some tangible reward from the human. She might behave according to the strategy that it is good to name because that may please the humans and may make them more willing and ready to give Tatu some sort of object or playful action at a later point in the interaction.

Another possible reason for Tatu's naming behaviour might be that she enjoys the social attention from and interaction with her human interlocutor. She might be socially and more extrinsically than intrinsically motivated in naming objects and pictures. She may do it because then she can have contact with the humans, but not because she has an interest in the

communication of names of objects and other items as an end in itself. Terrace (1979a) explained Nim's sometimes clear participation in naming sessions by assuming that a desire for social approval and social inclusion might have been his underlying motivation, rather than an intrinsic one for naming. With no further data on Tatu's naming behaviour it remains uncertain whether she is intrinsically motivated in naming.

To conclude with regards to naming, there is a need for more information on this behaviour in the signing chimpanzees. It definitely remains an interesting area, because it appears to be the only form of sign use in the recent corpora that could be a candidate for a more intrinsically motivated use of symbols. The rest of their signing behaviour in the analyzed corpora can now well be described as governed by external motivations. Future research on naming may give us more insight into this particular aspect of the chimpanzees' sign use.

The unclear use of the sign BLACK by Tatu.

The use of the sign BLACK by Tatu (see Figure 5.1.) took up a big percentage of the utterances that were coded as an Unclear communicative intention. Tatu's 87 unclear utterances with BLACK in the *1994* corpus accounted for 58% of the total number of Unclear utterances. In the *1999* corpus Tatu's BLACK utterances accounted for 29 of the 30 Unclear utterances. Two BLACK utterances in the *1992* corpus were unclear. According to the Gardners and Fouts, the colour black used to be Tatu's favourite colour. Only five of her recent utterances with the sign BLACK, however, were coded as Naming Properties. Two of these were from the *1994* corpus, the THAT BLACK utterances mentioned before. They occurred in a context in which black objects were present and Tatu was pointing to these objects. The three *1992* instances occurred in a naming conversation with a human, who twice held up an object and once pointed to a picture in a picturebook that all contained something of a black colour.

Figure 5.1. Tatu signing BLACK on the berm ledge. © Esteban Rivas.

The Fouts later interpreted the sign BLACK not only as a reference to the colour, but also as a sign that expresses like or positive affect. They came to this conclusion because Tatu appeared to be enjoying some event when she used the sign even though no black objects were present. They then compared the use of BLACK to the use of the English adjective *cool*.[352] In the Unclear instances of BLACK in the three corpora, however, the context did not allow for a certain judgment that she was expressing positive affect. What was clear from the videos was that the sign was often repeated many times, over and over again. Tatu drew her extended index over her brow to the side sometimes up to five times. In the *1999* and *1994* corpora there were several times that Tatu signed BLACK at about the time she was regurgitating food. In these instances she bent forward to regurgitate while signing BLACK, after which she chewed on the regurgitated food now back in her mouth, sometimes repeating the sign BLACK. This combination of signing BLACK and the regurgitation of food occurred 15 times in four different *1999* conversations, so in half of the times that Tatu used BLACK in the *1999* sessions. In the *1994* corpus this phenomenon occurred six times in six different sessions. Nevertheless, in all of these instances the coders were unclear as to the exact intention Tatu might express at these moments.

A different explanation than Tatu saying *cool* when signing BLACK in the Unclear instances might be that the sign carries no referential meaning, but has become something of a tic or a nervous habit. It may still have a positive connotation, because there must be some incentive for her to repeat it that often. There may be a pleasant sensual feeling in repeatedly pressing her index along the pronated brow characteric of chimpanzees. Whatever the eventual specific underlying motive Tatu may have, it is clear from this study that Tatu's unclear use of BLACK is a constant phenomenon that is consistent throughout the years. It appeared in the *1994* corpus of 1993-1994 and was also found in the *1999* corpus of 1999. A future study of Tatu's intriguing use of BLACK is definitely worthwhile.

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[352] "Tatu's infatuation with anything black went back to her childhood, when she started signing BLACK to refer to anything "cool," desirable, or beautiful, as in THIS FOOD BLACK or SHE BLACK" (Fouts, 1997, p.

Absence of certain communicative intentions.

A number of communicative intentions in the category system that was used were not present in the codings of the chimpanzees' utterances from the four recent corpora. Several reasons may account for the absence of these intentions. Below each absent communicative intention will be discussed and speculations will be made about the reasons why it may have been absent.

Naming Possession. There were no descriptions of the possession of an object. In the early reports of all projects, though, the chimpanzees used the possessives MINE and YOURS to refer to the possession of specific objects. Supposing these early observations were reliable, one should think of a plausible reason why the Possessions intention did not occur in this study. It may be the case that the chimpanzees have lost interest to communicate about the notion of possession per se. Describing possession in the service of obtaining an object might be a more obvious motivation for the chimpanzees. The early use of possessives may have worked in that way. In any way, it is certainly not necessary for the chimpanzees to describe possession in order to acquire things. In the recent signing in the analyzed corpora many other ways were found with which to obtain what they want. Simply uttering the requested objects (or actions), together with request markers, and the use of repetition or unstructured strings of signs are all useful ways to make clear to the humans what they want.

One might interpret the use of their name sign as a description of the possessor of certain objects. However, looking at the specific manner in which the name sign is used in the recent corpora, this does not seem likely. When they use their name sign the chimpanzees often ask for edibles that are usually not in their possession. Indeed, many times the object is not present yet. Rather than interpreting the name sign as the possessor of the utterances it is more plausible to see it as referring to the beneficiary, to whom the object is supposed to be given. However, it appears more to be the case that the name sign is not used referentially

here, but, as was discussed above, that it functions more as a wild card. It is thrown in among other signs in an unstructured manner and has the effect on the humans that they are more inclined to give something to the chimpanzee.

Communicating about possession may therefore have been less a spontaneous intention but more one that the humans introduced in the interaction. From the early days onwards, a routine interaction was set up in the form of a game. An object would be laid out between a human and chimpanzee, the human would ask WHOSE? and depending on the chimpanzee's answer the object would usually be given to its possessor. If the chimpanzee responded to the human WHOSE? question with ME or their own name sign, the object would be given to the chimpanzee. If the chimpanzee signed YOU or the human's name sign then the human would get the object. One gets the impression that this sort of game was played more in the days when the chimpanzees were not behind bars and the humans and chimpanzees moved freely around each other. It may be that the humans in recent days make use less of this routine.

Naming Location. In the data on combinations from the recent corpora, it was found that there was only one candidate for the semantic relations involving location (locative action and object+location). This consisted of object and action signs combined with the pointing sign THERE. It was concluded, though, that these utterances appeared more like pointing towards the place where the objects were that the chimpanzees desired, rather than that they were giving a symbolic description of a location. Remember also that the presence of only one locative sign in these combinations is not sufficient to call it a semantic relation. Furthermore, all the utterances with THERE were not coded as naming Locations, but as Requests for objects and actions. The utterances were often part of series of requests for certain items. Often the chimpanzees first asked for something, and the pointing to the objects' location (or the objects themselves) then usually followed when there was no

cooperative reaction from the human. They were thus interpreted as further request utterances, further attempts to get the human to bring them what they wanted.

All chimpanzees in the projects had locative signs in their published vocabularies. It may be that these were part of actual descriptions of locations in earlier days. Maybe the chimpanzees not only said that an APPLE was THERE, but also that the APPLE was UP a tree, DOWN the bottom of a drawer, IN a box, or OUTside. However, with these locative signs too, it may have been the case that they functioned more as signs to get the human into action to get them what they wanted, rather than that they referred symbolically to the locative states. IN and OUT may have been signs with which to ask for the action of being let in or outside. It was reported for UP that it was part of play routines where the chimpanzee would be held up when this sign was used. In a similar way as the sign SMELL in recent days is a request for the human breath-blowing routine, UP may have been used as the sign that requested the "holding-up" routine. Also, the use of these locatives may have occurred nonspontaneously as routine answers to WHERE questions from the humans.

Though the issue of possession may be less relevant in recent days, a detailed reference to a specific location might still be useful now. For example, in the *1993* sessions Moja might have signed UP if Bodamer was looking for clothes at the wrong shelf. Similar to the reasoning above at the Possession intention, though, is the fact that most locations can be indicated without further specific locative signs. Pointing to the place is usually sufficient. There is no necessity to use other locatives. And even pointing may not always be necessary to get what they want. When watching the videotapes, one gets the impression that the only thing the chimpanzees need to bother with is utter an object sign, regardless of the particular location the object may be in. This is because the humans are generally so helpful that they will look for an object even though its location has not been explicitly specified by the chimpanzee. This type of human reaction to such simple or "reduced-to-the-utmost-necessary" communication by the chimpanzee may have had its impact on the chimpanzees'

use of signs. If uttering APPLE rather than THAT APPLE THERE brings you the same result (because of the humans' willingness and serving attitude), the need to utter more than APPLE alone becomes obsolete.

Protesting. This intention was reported by the Gardners, especially in the use of negative signs such as NO. However, in the recent corpora no instances were found of this intention. It may be relevant here that in the current living conditions of the chimpanzees, there may be little the humans can force on the chimpanzees, nor can the humans do many things to the chimpanzees that they do not like. The separation of the chimpanzees and humans in the form of bars or glass between them, makes a domineering attitude of the humans where they dictate what is happening actually impossible. The chimpanzees can simply remove themselves from an enclosure when they are fed up with a human and his or her behaviour. The prescribed and adhered attitude at the CHCI departs from the premise that the chimpanzees' interests come first. The humans working with the chimpanzees are therefore well aware of the effect that their behaviour may have on the chimpanzees. This makes them relate in a manner of respect and love towards them, thus giving as little cause for protest as possible. Also, when the chimpanzees want to protest, they can carry out highly effective nonverbal protest behaviour. They can threaten or show other forms of agonistic behaviour. They can bang loudly against the enclosures' walls or caging, while making a great deal of noise, screams and other protest vocalizations. A particular behaviour in the CHCI chimpanzees is their use of spitting. They can spit to protest an ongoing human behaviour they dislike, and also to try to force a human into fulfilling some request. The author himself was spat at many times by Loulis, who often wanted attention and chase games. When the author would sign I WORK or I CLEAN, thus excusing himself, Loulis would not give up and fill up his mouth with water to spit it on the author (often waiting until he could spit him right in the face). This spitting behaviour by Loulis was also found on several instances on the videos used for analysis in this study. The chimpanzees thus have

sufficient behaviours with which to protest. There may be no extra need to use signs to express this intention. Or at least this is so for these chimpanzees. One could still imagine many ways in which it would be useful to explicitly sign what they protested. They might sign utterances such as YOU DIRTY NO WORK PLAY CHASE, or ME OUT NO FOOD NOW. Signed utterances such as these could specify exactly what it was that bothered them. The context of their nonverbal protest behaviour often indicates what it is they protest, but this may not always be the case. Apparently, however, in the recent corpora the chimpanzees had no need for such explicit clarification.

Calling/Attention. The chimpanzees generally draw the humans' attention through nonverbal means, by producing sounds such as raspberries or bronx cheers. Clapping their hands also occurs. Because signs are usually produced without sound, they may sometimes not be sufficient to get the humans' attention when their visual field is not directed to the chimpanzee but somewhere else. However, in Bodamer's study on chimpanzee initiation of interactions it became clear that certain signs can be made in a noisy way in order to draw the human's attention (see section 2.3.). Noisy signs such as DIRTY and PERSON were effective attention-getters. However, these signs may not be used referentially in these instances, but in a nonreferential, instrumental manner. In the recent corpora no instances were found of a possibly greeting quality of a sign such as HUG or of calling humans by making the human's name sign (despite the fact that most people in the CHCI have name signs). Again, then, as in the Protesting intention, the chimpanzees' expression of this communicative intention is effectively taken care of nonverbally.

Apology/appeasement. In all projects it had been reported that the chimpanzees used signs such as SORRY and HUG as a way to apologize when they had done something that the humans did not like. They also used these signs to appease the humans when punishment was imminent. Terrace and his colleagues, however, already mentioned that this might not be a true expression of apology, but had evolved as a pragmatic sign to manipulate the human

reaction when they had done something wrong (see footnote 70 in this dissertation). In the current living conditions in the chimpanzee institute there are various things the chimpanzees can do that can make the humans upset and make them desire an apology. For example, the chimpanzees may poke the humans through the bars, when meals are given. Or at the end of the day they may not come inside to their night enclosures and prefer to stay in the outside enclosure. However, the relationship between the humans and chimpanzees is generally a peaceful one and the appropriateness of this intention may only arise infrequently. One also gets the impression that making explicit apologies or appeasements is not that necessary anyway. Usually the humans want the chimpanzee who misbehaves to stop what he or she is doing or to calm down. As long as the chimpanzee does this, there is no additional need to apologize, unless the humans are going to punish the chimpanzee and the chimpanzee wants to prevent that. This last thing, punishment of the apes by the humans, occurred with some frequency in the first few years of the different ape language projects, when the humans were still stronger, physically, than the chimpanzees. In Oklahoma, on order of the institute director Bill Lemmon, cattle prods that could give electric shocks had to be used to deliver punishment or to discipline and "correct" the chimpanzees' behaviour (Fouts, 1997; Linden, 1981). However, in this day and age, the apes are all mature and powerful, the enclosure ensures less physical contact, so punishment of the chimpanzees by the humans has become less of a possibility and therefore also the need for apology/appeasement. The only time that the author observed punishment in the CHCI occurred at a few times when one or two of the chimpanzees stayed in the outdoor enclosure too long. If they did not come in for their meal when the humans asked them to, they did not get the meal that had been served to the other chimpanzees who did come in while the mischievous chimpanzees were still in the outdoor enclosure (meals are given immediately after the chimpanzees enter the night enclosures from the outdoor enclosure).

Internal reports and Attributions. Obviously, the chimpanzees express and communicate their feelings and internal states through all kinds of nonverbal means: vocalizations, facial expressions, body postures, and natural gestures. No signed instances of this intention were found in the recent corpora. However, especially the Fouts had reported the expression of this intention in multiple earlier incidents. Apparently the motivation of the chimpanzees in the hours spanning the four corpora was with something else than the reporting of their inner states. Because instances of this communicative intention in particular could be very useful for the study of the consciousness and inner being of these chimpanzees (and the subject of animal consciousness at large) the author would like to express the need to continue collecting filmed corpora to still find possible instances in the future.

Explanations and Evaluations. These intentions would be useful in the interaction between the chimpanzees and humans. No exact instances of these intentions were reported for the earlier days and none were found in the recent corpora. It may therefore be again a question of either necessity or motivation. Either the chimpanzees can transmit the information that they want to communicate without having to express such more linguistically advanced communicative intentions. Or they may not be interested to communicate about reporting reasons, causes or motives for acts nor about impressions, attitudes or judgments about objects or events.

Requests for Information. No utterances were coded as this intention in the recent sign corpora. There were several occasions on which the chimpanzee made a modulated sign utterance in a way that could be interpreted as a question. In these instances the chimpanzee held the last sign of an utterance and looked prolongedly at the human to await an answer. However, all of these instances were coded as requests for objects or actions rather than for information. They are more suggestive of the chimpanzee asking for objects or actions and are less plausible as the chimpanzee desiring to obtain some verbal information from the human. This finding adds strength to the argument in chapter 3.4. where the examples of

questions published by the Gardners and Fouts were criticized for not making a difference between these quite different kinds of questions. The presence of the question modulators in these utterances are therefore no justification for ascribing informative question-asking to these chimpanzees, comparable to the questions for information human children start asking very early on in their language acquisition. Instead the holding of the sign and the prolonged looking are better interpreted as appropriate accompanying behaviour to express a request for more material things: objects and actions.

LANGUAGE

The recent signing of the chimpanzees in the four corpora can not be characterized as linguistic.

Taking all of the characteristics of the recent signing of the chimpanzees in the four corpora into account, a judgment can be made with regards to the language question. It may be the case that the signs are actual symbols for the chimpanzees (see Part II below). However, this may be the only similarity with language. The other characteristics of language, especially the combinatorial properties, are altogether absent in the analyzed corpora of recent sign use. If one takes a definition of language which includes the structured combining of symbols as sentences that express more than single symbols, than the five chimpanzees' recent signing in the four corpora is not linguistic. Indeed, there are many reasons to assume that the signs function instrumentally to acquire things rather than that their sign use shows the many other functions of language. Recall here the predominance of requests, the absence of structure in combinations, the presence of wild card signs, and the use of many repetitions of signs. The conclusion of the Terrace team on chimpanzee signing is therefore appropriate for the signing in the recent corpora as well. The chimpanzees have not grasped signing as language, but use it for their own communicative purposes. Sometimes there is an appearance of linguistic use,

but this is more a mimicking rather than a real understanding of the rules of linguistic interactions.

Now that all major findings of the study on the sign behaviour of the chimpanzees in the four recent corpora have been summarized and discussed, the table at the end of chapter 2 can be expanded with these results. In Table 5.2. the main results and conclusions of the Gardners and Fouts, and that of the Terrace team, are compared with the findings on the recent sign behaviour in the four corpora. Notice the many similarities of the sign behaviour in the recent corpora with the signing reported for Nim.

Table 5.2. Main results and major conclusions of the projects with signing chimpanzees compared with the recent signing behaviour in the four corpora.

	Gardners and Fouts	**Terrace**	**Signing behaviour recent corpora**
Signs: Reliable vocabulary at end of projects	Washoe: 133 signs. Moja: 168. Tatu: 140. Dar: 122. (end of G projects) Loulis: 51 reliable+observed signs.	Nim: 125.	Used number of signs: Washoe: 43. Moja and Tatu: 55. Dar: 38. Loulis: 4.
Semantic categories of individual signs	Objects, actions, (generic) names, person terms, locations, colours, possessives, materials, quantitatives, comparatives, qualities, request markers, traits, question signs, and others.	Objects, actions, names, person terms, locations, colours, qualities, request markers, traits, and others.	Objects, object/actions, request markers, YOU+ME, chimpanzee name signs, BOY, HEIDI(?), ROGER(?), actions, THAT/THERE, colours, HOT, SWEET(?), GOOD, NO(?). (in order of frequency)
Further conclusions on individual signs	Striking similarity with early vocabulary human children.	Skewed use of signs: very frequent use of wild card signs.	Skewed use: 10 signs cover 60%. Wild card signs.
Combinations: MLU	Objections against this measure.	No increase, fluctuation between 1.1 and 1.6 signs.	
Semantic relations	74 to 90%: Same relations present as in human children's first combinations.	No variety in semantic roles. After video analyses: no evidence.	No evidence.
Creative combinations	Occurred often. Washoe: WATER BIRD for swan.	No evidence. Strings may be unrelated or randomly generated.	No instances.

Table 5.2. ctd.

	Gardners and Fouts	**Terrace**	**Signing behaviour recent corpora**
Sign order	Several position patterns reflecting syntactic rules.	Unknown what orders reflect. Imitation may play a role.	Clear pattern: object/action + request markers/THAT/THERE/ YOU/GOOD. Not syntactic, but acquisitive.
Inflectional devices	Reiteration and establishment of loci.	Repetition only to get what they want.	
Multiple-sign combinations (3+)	Increase in informational content. Repetition and redundancy also present.	Characteristics: repetition, redundancy and wild card signs. No increase in information.	No increase in information. Repetition, redundancy, wild card signs. Strings without structure.
Discourse: Spontaneous signing.	Spontaneity only defined with regards to imitation. Great majority of sign interactions initiated by chimpanzees.	Nim 10 to 13% spontaneous (no preceding human utterance). Less than human children.	Signing is spontaneous, though majority follows some form of human prompting.
Interruption	Normal turn-taking behaviour.	Nim 71% overlap with human. No grasp of turn-taking.	
Imitation	Imitation as pragmatic device, less than Nim. Criticisms on Project Nim to explain different results.	Unexpected finding: 39 to 54% of adjacent utterances. Higher than human children.	20% of times a sign was made. 18% of utterances. Much lower than Nim.
Communicative intentions	Requests for objects, actions. Naming, making comments, asking questions. Intrinsic motivation to communicate information. C-c signing socially oriented. Internal state reports (CRY, etc) and insults (DIRTY). Private signing.	"Acquisitive" motivation: requesting objects, actions, etc. Naming. Private signing. Children, however, use language "for the sake of it."	Predominance of requests for objects and actions: 86%. Naming 2%, but usually after human prompt. Answering 4%, often with name sign. Unclear 8%, mostly Tatu's use of BLACK. Unprompted (18% of utterances): 94% requests.
Language	Chimps acquired human sign language. Continuity argument. Many similarities with child language development.	No evidence for language. No sentences. Big differences with human children.	No evidence for linguistic characteristics. Signs may be symbols, but many differences with children.

Reflections on the chimpanzees' earlier signing.

The chimpanzees' recent sign use in the four corpora does not show many of the qualities and abilities that the Gardners and Fouts had found in earlier years. It has many similarities with the way that Nim signed. Many of the conclusions of Terrace and his colleagues are applicable to the recent signing of the five chimpanzees in the analyzed corpora.[353] In chapter 3 several problems of methodology and interpretation were presented of which the earlier sign language research with apes had suffered. The results of the current study then bring up the question whether the signing in the recent corpora may actually be characteristic of these same chimpanzees' earlier sign use as well.

Obviously, the results of this study do not necessarily mean that the recent signing behaviour of the chimpanzees in these corpora is in effect the same as their early signing behaviour. It may be that the early signing contained all the regularities and phenomena that the Gardners and Fouts claim to have found. However, though this current study has no possibility of disproving the descriptions of the early signing, it certainly does not confirm the early reports. No matter what nature the early signing actually had, the results of this study have to be incorporated in a longitudinal picture of the chimpanzees' signing behaviour throughout the years. Two possibilities then exist. One possibility is that the early signing behaviour was indeed similar to the recent signing analyzed in the four corpora. In that situation it is not necessary to postulate a change over time. The nature of the recent signing in these corpora is then characteristic of their early signing as well. From early on then the chimpanzees had no structure in their sequences of signs, made use of wild card signs, imitated human signs, and had a predominantly acquisitive motivation for using signs.

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[353] Indeed, the findings on the sign use in the recent corpora correspond to the expectations Terrace (1981) had about the signing of the apes in a more mature age:

> I know of no evidence that their linguistic skills increased as they became older. An ape's intelligence undoubtedly increases after infancy. One must, however, also keep in mind that as an ape gets older, its ability to master its environment by physical means also increases. An ape's increasing strength and its recognition that it can get its way without signing should result in *less* motivation to sign and a reduction in its teacher's dominance. I am therefore skeptical of conjectures that an ape's increasing intelligence [as an ape gets older] would manifest itself in a more sophisticated use of language. (p. 107)

Generally, their signing had too many differences with human children's early language that the term "language" was not an appropriate description of their sign behaviour. As the reports on Nim's signing accord well with the chimpanzees' recent signing in the corpora, Nim's signing would then be characteristic of the signing by Washoe and the other four chimpanzees. However, the reports by the Gardners and Fouts contradict such a characterization. These reports then have to be explained. In chapter 3 it was shown that there was not enough evidence for the patterns and regularities that were claimed by them to occur in the chimpanzees' early signing. There have been many problems of method and interpretation in these reports. The use of anecdotes, insufficient systematic use of large corpora, the presence of drill and other specific methodological problems can account for the difference between these early reports and the findings on the chimpanzees' recent signing in the analyzed corpora. In this possibility then, the early signing was the same as their recent signing in the corpora, but problems of method and interpretation led the Gardners and Fouts to an inaccurate characterization of the signing behaviour in the early years.

In the other possibility, the early signing of these chimpanzees was different from their signing behaviour in the recent corpora, and the reports on the patterns and regularities of their early signing were appropriate descriptions. In this situation an explanation must then be found for the change that occurred over time. The signing behaviour of the recent corpora does not accord well with the early characterizations. If we speculate for a moment that the signing in the recent corpora is representative for their overall signing behaviour in recent years, then an explanation must be given for the fact that in the early days the chimpanzees acquired a languagelike behaviour, combined signs meaningfully, transmitted complex information, and even used grammatical rules, but then stopped signing linguistically in later years. This may be difficult to do. One has to think of factors that depressed their signing and eventually changed it into the structureless, acquisitive signing of the latter days. One factor may have been of particular influence: the increasingly incarcerated housing conditions of the

subjects. Other factors may have played a part, for example, that the humans in later years may have been less fluent in ASL and so influenced the chimpanzees' signing.[354] The captivity factor, though, may have played the biggest part, so that factor will be addressed here.

The increased captivity and reduction of the chimpanzees' quality of life may have caused an unexpected decline in their signing abilities. In the Kennerud and Bodamer studies the chimpanzees were still living on the third floor of the Psychology Building of CWU, where their enclosures were limited and they were never exposed to sunlight. The 1994 study and the 1999 sessions took place in the CHCI building, where the chimpanzees have been living since May 1993. This new housing is an incredible advance towards the chimpanzees' psychological well-being, because it is considerably larger and the chimpanzees now have an outdoor enclosure as well. However, even in this building, and ever since the chimpanzees came to Ellensburg, they have had to be kept in captivity, frustrating full control over their own daily lives and making them dependent on humans to a large extent in fulfilling their needs. One can therefore expect that the chimpanzees request things that they do not have access to in their captive condition. The relative dominance of requests in their utterances may well reflect this increased dependence on humans and their relative inability to control their own lives. The descriptions by the Fouts and Gardners of the chimpanzees' sign use before they had to be confined in enclosures, might therefore still reflect the signing of the early years.

It is obvious that captivity causes suboptimal living conditions for the chimpanzees in Ellensburg. There exist some clear welfare issues. Some of the chimpanzees show evidence of several stereotypical behaviours (though these have not been systematically studied yet).

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[354] Another possibility may be that younger animals differ from older animals in their cognition and consciousness. In *The Self and its Brain* the philosopher Karl Popper suggested such a difference. The behaviour of young animals "shows many more signs of consciousness" than that of old animals. According to Popper "it is very possible that animals lose this consciousness as they grow older and that they grow more and more like automata," (Popper & Eccles, 1977, p. 446). If Popper's hypothesis is correct, then the decrease in linguistic characteristics of the chimpanzees' signing behaviour over time could be explained by a decrease in cognition or consciousness.

Also present are certain management problems in which the chimpanzees question the authority of their human caretakers. Subjectively, one gets the impression that boredom and frustration take place practically every day. The chimpanzees' lives have become more monotonous and less varied now that they are behind bars and glass and never get to be taken outside of the building. This lack of stimulation from their environment may cause some depression of their linguistic skills, or indeed of their motivation to communicate.

However, one can also look at it the other way around and claim that in a situation of deprivation language and communication become even more important. Talking with others can be a way of venting one's frustration, of communicating the feelings and thoughts one has in the deprived state, of exchanging information, or even of playing language games to relieve one's situation. In the daily life at the CHCI, where every day can sometimes appear the same, having signed interactions with the humans would be a welcome distraction and spending of time. So rather than concluding that a state of captivity depresses language or communication, one can argue even better that captivity causes language and communication to be even more central and important in one's life.

More doubts about the validity of the captivity argument come from the fact that, as far as is known, language never declines in humans. No empirical findings suggest that linguistic abilities, as fundamental as those reported in the chimpanzee studies, can decrease over time. Of course the size of one's vocabulary may go up and down. But basic fundamentals of language, such as the expression of semantic relations, have never been reported to disappear when a human's living conditions get rough. There have been some interesting cases in which humans had been depressed in their language acquisition by being reared under deprived, usually quite horrible conditions (cf. the case of Genie, see Curtiss, 1977). Being held captive in the house, and sometimes even just a room, was usually part of these conditions. However, parental neglect was always the case as well. The particular children in question also did not get enough two-way communication with their parents for

their language to develop steadily. In the CHCI the chimpanzees are held captive, but in contrast to the child neglect cases the humans are communicating, signing and talking to the chimpanzees almost all the time, so there is constant exposure to language.

In response to the results of this study one might also say that the general recent signing of the five CHCI chimpanzees is still similar to the reported earlier signing. An explanation of the discrepancy would then be that more interesting things happened in incidents that were accidentally not reported on film. It may be that the more complex and linguistic sign use of the chimpanzees takes place when a camera is not around. In psychological research it is known that even the presence of a camera causes people to behave differently. The chimpanzees at the CHCI, however, are very accustomed or habituated to the presence of cameras. Almost daily certain aspects of their lives are filmed, like when a holiday is celebrated or when an interesting dinner is laid out for them and the humans want to have their reactions on film. Also, the humans with which they interacted in the recent corpora were no strangers but longtime companions of the chimpanzees (with an acquaintance ranging from 1.5 to 15 years). Moreover, linguistic basics such as semantic relations are not the kind of things that are only shown on rare and incidental occasions, or only when no camera is present. Once children have acquired the expression of semantic relations, the advantages this has for their communication ensures its frequent employment of them in their utterances.

The current study can only lead to conclusions about the chimpanzees' recent signing. Their early signing may have been similar to the recent use in the analyzed corpora, but it may also have been different, in the ways reported by the Gardners and Fouts. Future research should therefore be carried out to get closer to a more definite answer on their early signing. If old corpora still exist in some form, it is important to analyze these systematically. Preferably film and video data should be examined. For example, it would be of great use to have the full unedited transcripts of the videotaped sessions with Dar that were used for the

Rimpau study on inflection. The method of analysis used in the recent sign study could then be applied as a standard for these older corpora analyses. Contrasting or agreeing data might then be found regarding the chimpanzees' early signing. Also, a study like the one described in this dissertation could become a regular practice at the current CHCI. Every year a large corpus could be gathered on film and analyzed in the same ways as done here. One might then find new phenomena that are in more accordance with the early descriptions, which would strengthen the plausibility of the early characterizations.

If old corpora are not available and new corpora show the same results as in the current study, no new knowledge will exist on their early signing behaviour. In that situation the reports by the Gardners and Fouts are all that exist. These may be accurate descriptions of the chimpanzees' signing in those days. However, the many problems that exist with the early data do not make for a firm ground for these descriptions.

PART II.

THE STATUS OF THE SIGNS: SYMBOLS OR CONDITIONED RESPONSES?

The conclusion on the recent signing behaviour of the chimpanzees in the four corpora is that it cannot be considered to be linguistic in nature. However, this does not have to imply that the signs they acquired were conditioned responses without reference. The apes may well have grasped the symbolic nature of the signs. This subject has not yet been discussed in this dissertation. It is now appropriate to spend some words on it. The issue has led to some argument in the ape language controversy.

The debate has centered on the question whether the signs are simple stimulus-response associations of particular signs with particular objects and actions, or whether they

can be interpreted as symbols that stand for certain concepts or mental representations. In discussing this particular issue, it is helpful to start with Terrence Deacon's description of reference. In chapter three of his interesting book *The symbolic species* (1997), he explains in detail the actual difference between a conditioned association and a full symbol. Deacon distinguishes three separate levels of reference within a hierarchical structure of increasing symbolization. He uses the classification of representational relationships of the American philosopher Charles Sanders Peirce as a point of departure (see The Peirce Edition Project, 1998). Peirce distinguishes three levels or categories of referential association, that have often been formulated in philosophy of mind. They are three different types of signs:[355] the icon, the index, and the symbol. On each of these levels a different relationship exists between the sign and the physical object that is represented.

With icons there is a similarity between the sign and the object. There is a relationship in form, a resemblance between the two, as in a portrait or a picture. The iconic reference process takes part as follows: "The form of a sign stimulus (S) elicits awareness of a set of past stimulus memories (e.g., mental "images") by virtue of stimulus generalization processes" (p. 79). Deacon says that iconic relationships are the most basic way by which things can be represented. He calls it the bottom of the interpretive hierarchy on which all other forms of representation are built.

With indices there is a physical or temporal connection, a contiguity or correlation, between sign and object. There is a causal link between the two or an association in space or time. An index seems to "point to" the object. Examples are thermometers that "indicate" the temperature, a weathervane indicating the direction of the wind, and an unpleasant odour that might indicate the presence of a skunk. Deacon says that most forms of animal communication are indexical in nature. Thus, pheromonal odours indicate the physiological state of an animal, and alarm calls indicate the presence of a predator. Another example that

[355] Note that this term refers here to something else than a sign from a sign language. Peirce defined "sign" as anything that represents or indicates something else. Its three varieties are the to be mentioned icon, the index,

is mentioned is the smell of smoke as an index of fire. The repeated correlation of smoke with fire (or the repeated representation of both on an iconic level in the mind) leads to this second hierarchical level of representation. Because of the repetition in contiguity, smoke becomes an index of fire. Indexical interpretation thus comes about "as a result of day-to-day associative learning," and "is essentially the kind of reference provided by a conditioned response" (p. 78-79).

Lastly, with symbols there is only a formal or conventional connection that does not relate to any of the (physical) characteristics of sign or object. There are social conventions, tacit agreements or explicit codes that describe the relationship. Examples of symbols are a wedding ring that relates to a marital agreement, or the letter *e* relating to a particular sound in words. A sentence comprised of words relates to a particular idea or set of ideas. In contrast to indexical associations, however, in symbolic interpretation there is not just a simple pairing of a sound or word with something else at work. A rat learning to correlate hearing the word "food" with food being put in his tray, though attentive to words, has only learned the indexical relationship between the two. For an animal to have passed the symbolic threshold, it needs to have an understanding of the symbol's meaning. The way such understanding can be demonstrated is of relevance for the signing ape projects. The grasp of the meaning of a word (or a sign) can be indicated by using the word correctly in a variety of contexts, as in a new sentence or novel context. Incorrect use out of context might mean the word was learned as "part of an unanalyzed phrase, or mapped to some restricted acquisition context" (p. 80).

Nevertheless, using a word or sign in a variety of contexts still need not mean that a symbol is acquired. A person could fool us into believing he or she understood the meaning of a word, by only taking into account that a word or phrase is appropriate in a variety of contexts that share certain features or social relationships. Such associative usage can be explained by a process called "stimulus generalization," that is, the transfer of associations

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and the symbol. A sign from a sign language is an example of the symbol variety of a Peirce sign.

from one stimulus to another similar stimulus. It can also come about by the transfer of learning sets, where an animal fulfills a task on the basis of the similarity between two learning tasks in different, though similar contexts. Deacon describes how stimulus generalization and learning set transfer take place:

> There is always some ambiguity as to what are the essential parameters of the stimulus that a subject learns to associate with a subsequent desired or undesired result: learning is always an extrapolation from a finite number of examples to future examples, and these seldom provide a basis for choosing between all possible variations of a stimulus. To the extent that new stimuli exhibit features shared by the familiar set of stimuli used for training, and none that are inconsistent with them, these other potential stimuli are also incidentally learned. (p. 81)

Animals in experiments could be trained (and have been, see the work of Herrnstein with pigeons (Herrnstein, Loveland & Cable, 1976)) to group together and produce some sign for different kinds of objects, and even classes of objects, such as trees, bodies of water and others. However, their grouping may not have taken place by applying symbolic criteria, but by use of the iconic overlap that is the basis for their common reference at an indexical level.[356]

According to Deacon, the way in which words can truly be demonstrated as symbols is by showing that they have a referential relationship with each other, with other words. Each word has specific individual relationships to all other words within a language. As in a dictionary, each word is mapped with other words. Words (and symbols in general) have a dual reference: they refer to objects, and to other words (or symbols). This is the same as the

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[356] Of particular interest here is Herrnstein et al.'s argument, drawn attention to by Wallman (1992), that stimulus generalization can actually not account for the success of the pigeons in their experiments. They say that it is an inadequate explanation because there was no common sensory attribute or constellation of stimuli between the different pictures that were part of one and the same category (of trees, bodies of water, and particular persons). Wallman quotes them (and adds): "'We can describe [the pigeons'] behavior pattern better by noting what the pictures are pictures *of*, rather than by what the pictures themselves *are*' (1976, p. 299). If it

classic distinction between sense (pointing to other words) and reference (to objects). Every word has a particular semantic and grammatical category and in this way it is also related to other words.

Deacon sees the Rumbaughs' experiments with the (common) chimpanzees Sherman and Austin as evidence for nonhuman animals who made the shift from the indexical to the symbolic level, albeit in a very limited manner and not resulting in a new, regular form of communication. The best demonstration of symbolic ability was found in an experiment where the chimpanzees learned lexigrams that stood for the categories "food" and "tool," by training these with objects. Sherman and Austin then had to determine for novel food and tool objects whether they were a "food" or a "tool." They did so successfully. They appeared to have learned the symbolic quality of the lexigrams. In later procedures, Sherman and Austin were even able to appropriately sort the lexigrams for individual food or tool items (so not the objects themselves) to the lexigram for the general category of "food" and "tool" (Savage-Rumbaugh, 1981). Deacon adds that the results from the Rumbaughs' studies may not be the last word on the possibilities of nonhumans to progress onto the symbolic level of communication. He considers Kanzi to be an ape who has demonstrated "far more effortless and sophisticated symbolic abilities" (p. 92).[357]

Turning now to the protagonists in the ape language controversy, Terrace and colleagues often use the term symbols to describe the nature of the signs that the chimpanzees have learned (1979a, 1985a; Terrace & Bever, 1976; Terrace et al., 1979, 1980). These are arbitrary symbols in the sense that their form has no relationship to the objects that were symbolized. However, confusingly, Terrace uses the term symbols both to describe a paired associate as well as actual symbols of a referential nature. In his 1985a article *In the beginning was the "name,"* he states that the symbols of the signing apes are nothing more than associations paired with a particular discriminative stimulus, used as a means to obtain

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is necessary to attribute such abstract mental entities to pigeons, it would seem reasonable to interpret similarly the apes' range of sign deployments" (p. 64-65).

some reinforcer. He then presents the experiments by the Rumbaughs with Sherman and Austin as evidence that apes can learn more symbolic skills in that they have shown to be capable of using symbols to identify a concept and to indicate an object even when it is not present. At least these apes then, have gone beyond the paired-associate level and have mastered reference through symbols. Nevertheless, Terrace says that this is still different from what human children acquire: names. This difference between symbols and names is not a difference on a referential level, but a difference in functions or intentions of the symbols. Children name objects spontaneously and without a desire to obtain them. They name for the sake of it, with an intrinsic pleasure. This form of naming is absent in the current reports on the apes' signing as well as in the use of lexigrams by other apes. Thus, though both apes and children can learn to acquire symbols, apes only use them with external motivations, whereas children intrinsically communicate symbolically.[358]

Petitto and Seidenberg (1979) explicitly related the signs made by the apes to the different forms of sign as distinguished by Peirce. They say that, as can be expected for all languages, certain signs are iconic in form. One example is the sign SHOE, that is made by the index edges of both fists contacting repeatedly. In ASL the sign is similar to the clicking of two heels together. Indexical signs in the apes' vocabularies, according to Pettito and Seidenberg, are EAT, ME, YOU, GO, COME, BRUSH, GROOM, UP, DOWN, GIVE, THIS, THAT, THERE and still others. All of these are correlated in time or space with the object or activity they refer to. They are either made with a movement that is part of the referent, or they involve pointing to the referent.

As to the question whether some of the signs may be symbolic in nature, Petitto and Seidenberg have a somewhat different opinion from Terrace. While Terrace allowed for the

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[357] See Part III below for a discussion of the results of the research with Kanzi.

[358] Terrace (1985a) and his colleagues (Terrace et al., 1979, 1980; Seidenberg, 1986) have related this difference between apes and children to the concepts of "mands" and "tacts" as defined by the behaviourist psychologist B. F. Skinner. Mands are words or signs produced to request various reinforcing agents. Thus the chimpanzees' signs are mands that are made because the chimpanzees are asked to do so (by the humans) as a means to obtain something. Words or signs in the form of tacts on the other hand, function to identify things or convey information, which is what human children quickly learn to do when they acquire language.

apes to have acquired symbolic communication (though not naming), his colleagues argue that there is no evidence that the signs are something more than associative responses evoked by stimuli. They say that had there been reliable reports of the use of certain signs out of the immediate context of the referent, in the form of displacement, the signs might still be symbolic in nature.[359] With the data that exist, the chimpanzee signs are at the most indexical in nature. This means that the sign behaviours need not go beyond conditioned responses: "their status is simply that of other arbitrary operants" (p. 170). They mention stimulus generalization as an explanation for the use of learned signs in novel contexts.[360] Seidenberg (1986) concludes that Nim was able to associate and produce signs for particular objects as well as classes of objects. However, his general use of signs makes him skeptical nevertheless about his ability or interest in communicating in the form of naming. This is because in routine, stereotypic situations Nim was not specific in what he signed but used signs from groups or clusters of signs that he had associated with the routine everyday situation: "For example, eating contexts ... would invariably provoke a cascade of eating-related signs: eat, more, drink, give, etc" (p. 39). The same would happen in the context of looking at a picture-book with another cluster of signs (see also Seidenberg & Petitto, 1979). Savage-Rumbaugh and Sevcik (1984) also see the stringing of signs without structure as indicative of the fact that the chimpanzees have difficulty understanding that each sign is a specific symbol for a different entity. The stringing suggests that they use all the signs as indicators to obtain a desired object or action. Seidenberg & Petitto (1987) further claim that

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[359] According to a personal communication from Terrace, reported to Ristau & Robbins (1982), Nim "almost never signed for objects that were not physically in view" (p. 195).

[360] In 1986 Seidenberg's conclusion is as follows: "The apes had little or no knowledge of the specific meanings or grammatical functions of signs; they were not symbolic, iconic, or indexical. None of this knowledge was required given the demand characteristics of these experiments" (p. 42). Then, in his comparison of the apes' use of signs as "mands," he says that these need not be expressed in linguistic form, but can be made without knowledge of the language at hand. Non-linguistic ape sign strategies like imitation and reliance on clusters of signs for stereotypic situations (see section 3.2.) are enough for the apes to produce signs and give the appearance that they are communicating meaningfully. Seidenberg continues: "If this view is correct, ape signing is more closely analogous to the use of tools than to language." Tools have no meanings and function as instruments by which one can realize certain desired outcomes. The apes thus have learned to use signs "instrumentally to meet the demands of the laboratory context" (p. 44). To which he adds the following footnote: "The extreme statement of this hypothesis is that the ape's behavior is similar to that of a dog that has

the particular use of the signs by the apes also shows that they are not symbols. The predominantly acquisitive way in which signs are used, implies that the chimpanzees have only learned that by using signs they can obtain any desired outcome. Would they have grasped the true symbolic nature, their communications would have been more varied, and have included statements and comments.[361]

Wallman (1992) also talks about decontextualization or displacement being something of a touchstone for the attainment of true linguistic symbols. The use of signs in the absence of their referents implies a decoupling of the sign and the object. It is only in the use of displaced reference that one can be certain that no particular external stimulus set in motion the associative stimulus generalization process. Since there are no reliable reports of displaced reference in the ape studies, there is no evidence for the signs being used as symbols. Wallman then compares the apes' signs to the linguist Elizabeth Bates' conception of children's earliest words as purely performative, "context-bound and nonsemantic, as game- or ritual-like behavioral components of recurrent activities" (p. 66). For this reason such primitive wordlike behaviours are called "protoimperatives" and "protodeclaratives" by Bates and her colleagues (1979). Drawing his conclusion then, Wallman says that the apes have acquired "a repertoire of habits that were *effective* rather than *meaningful*" (p. 77). Savage-Rumbaugh and Sevcik (1984) also mention the fact that human children use their first words in an instrumental, pre-representational sense. One example they give is the use of "mama" to request a desired object while reaching toward the object. "Mama" is not representational, referring to mother, but serves to obtain a desired response from a mother or another adult. Going back to the signing apes, Savage-Rumbaugh and Sevcik argue that a sign like OUT may be an interactive ritual that is signed when one wants to go out. The apes do not use it to describe a location of another person or object, nor do they use it to describe

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been trained to perform one arbitrary sequence of behaviors before being given a bone, and another before being taken for a walk."

where they have just been. It is always used within "the ongoing interactive routine in which *the context itself specifies the meaning of the symbol*" (p. 198).

Displacement thus being an important aspect of symbolic language, it is interesting to look at relevant findings in the recent sign use in the four corpora. Sometimes the chimpanzees request objects or actions in their recent utterances that are not present at the time. Some of the interactions start with the chimpanzee asking for a TOOTHBRUSH and other objects that are not in sight at that moment. They may therefore have been thinking about these preferred things and asked for them in the absence of the objects themselves. Thus, without the objects being able to function as stimuli that elicit a certain association. This then may be a demonstration of displacement and further reason to assume that the signs function as symbols rather than as s-r associations (see also Bronowski & Bellugi, 1980; Ristau & Robbins, 1982).

Then again, the chimpanzees also sometimes ask things by producing unstructured strings with object or action signs. These objects or actions are not present at that time either. Maybe the chimpanzees are then thinking and asking for multiple request items at the same time. However, it may also be that the chimpanzees are not referring to absent things, but rather string several useful signs in the hope of hitting on one that may provoke the human into the action of giving them something. This then would detract from the interpretation of their other less stringlike requests for absent objects as evidence for displacement.

The Gardners' vocabulary tests have been explicitly discussed with regards to the subject of symbols. The Gardners themselves interpreted the results of these tests as evidence that chimpanzees have natural language categories. Other authors, though, are of the opinion

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[361] They also say that the apes never acquire a metaknowledge about what names are, though children do: "[Nim] tried to respond appropriately to names and to produce them in a manner that would effect desired outcomes. However, he did not seem to realize that it was the name itself that mattered to his teachers" (p. 283).

that simple stimulus generalization can account for the success of the chimpanzees in these tests (Lenneberg, 1980; Premack, 1976; Rumbaugh, 1980; Wallman, 1992).[362]

Fouts and Mellgren (1976) have explicitly discussed the symbols issue. They say that they want to demonstrate that "a chimpanzee using sign language is not merely another example of a pigeon pecking at a key to obtain some grain or a rat pressing a bar to receive a food pellet" (p. 322). To which they immediately add:

> We do not mean to imply that there is a dichotomy between the simpler responses exhibited in the usual psychological laboratory study and the chimpanzee engaging in sign language activity. The basic principles involved may well be similar although we would probably not all agree on what those principles are.
>
> Perhaps the most straightforward way to explain the differences between a rat pressing a bar and a chimpanzee signing, or between a chimpanzee and a human, is to make reference to the degree of different behaviors. .... It can be argued that each organism learns associations but that the ability to use these associations in novel and unique ways may be restricted by the genetic makeup of the organism. That is, at present we see no reason to postulate a fundamental difference between the acquisition of sign language in the chimpanzee and a rat learning to press a bar in a Skinner Box. A difference that does seem to exist is the degree to which each organism is able to utilize past experiences in novel situations. We would maintain that the chimpanzee is more flexible in its ability to utilize past learning experiences in dealing with these novel situations.

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[362] Wallman: "a skeptic might characterize the animals' performance on these tests as demonstrating only a reliable ... rate of responding to classes of equivalent stimuli with rotely paired associates" (p. 64). Rumbaugh (1980) says that the chimpanzees' performance in these tests can be accounted for by "essentially generalized responses to stimuli similar to those used in prior training" (p. 242).

This reference to a difference in degree does not clarify the discussion. In most publications, though, Fouts interprets the chimpanzees' signs as symbols that refer to objects, actions and other things. The creative combinations that the chimpanzees make are considered evidence for the symbolic nature of signs: "The signs are not static symbols that refer only to one object or state, but they are dynamic symbols that can be used in various conceptually related situations in a manner that appears to represent a high level of cognitive functioning" (Fouts & Mellgren, 1976, p. 330).[363]

Duane and Sue Savage-Rumbaugh have repeatedly published on the issue of the nature of the signs learned by the apes (Savage-Rumbaugh 1990, Savage-Rumbaugh & Brakke, 1990). In 1980 Rumbaugh makes an argument that there is evidence that the signs are not just conditioned responses. This is because of the extension of certain signs beyond the exemplars that were used to teach the sign in the training stage. His conclusion therefore is that the chimpanzees conceptualized the meaning of certain signs in a semantic sense.

In several publications, however, Sue Savage-Rumbaugh (1984b, 1986; Savage-Rumbaugh, Murphy, Sevcik, Brakke, Williams & Rumbaugh, 1993) has stated that there is no evidence that the nature of the signs produced by the great apes goes beyond the level of conditioned responses. The apes learned to make such associations because they were trained by people that evoked their signing by telling them things such as "see a banana, make the sign for banana" (Savage-Rumbaugh et al., 1993, p. 15). Indeed, such "production training does not foster the referential decoding process; instead, it causes the subject to attempt to remember what to say when shown a particular object and consequently results in minimal transfer to other situations or communicative processes" (p. 18-19).

A relevant observation comes from their work with Sherman and Austin on tool lexigrams (Savage-Rumbaugh, Rumbaugh & Boysen, 1978). They found that their chimpanzees correctly named or labelled objects when only one or two objects were

[363] For a discussion of the subject of reference in one of the other signing apes, the orangutan Chantek, see the interesting chapter "The cognitive foundations for reference in a signing orangutan," by Miles (1990).

presented to them. However, when confronted with additional objects and different exemplars, the chimpanzees made errors, showed intersession forgetting and a decline in motivation to participate. This made the researchers conclude that the object names learned were of an associative nature only. They point out that their chimpanzees would have passed the Gardners 15-day criterion since they made one correct response each day. Thus, the signs learned by the Gardners' chimpanzees may not have gone beyond associative responses.[364]

Conclusion. If all presented data on the chimpanzee signs are taken into account, the following conclusions can be made with regards to the level of reference that these should be placed at. All chimpanzee signing can take place at the indexical level. This is because, different from the Sherman and Austin studies, there is no evidence to take it beyond, to the symbolic level. Furthermore, when one looks at the use of the signs in the recent corpora in particular, the interpretation of these signs as conditioned responses instead of actual symbols becomes all the more suggestive. This is especially so because of the meaningless stringing in combinations. Had the signs functioned as true symbols, wild card strings would have been less likely to occur. However, it has been demonstrated by other chimpanzee subjects that these great apes are capable of acquiring symbols, and that chimpanzee minds indeed contain concepts that are mentalistic in nature, and not just loose s-r associations (Byrne, 1995). In the absence of further data then, it cannot be ruled out that the signing apes are using the signs based on a grasp of their symbolic meaning. Should it be the case that the apes sign symbolically, one might then explain the existence of meaningless stringing as purely motivational. Though the chimpanzees would then grasp the individual signs' meaning, they would not be interested to use them in their communications, except in order to get what they want. Then again, the acquisitive nature concluded upon by Terrace, and so abundantly demonstrated in the sign use of the recent corpora, makes one wonder about this latter possibility. A being beyond the symbolic threshold, who has acquired symbols with specific

[364] See also Premack (1990) on the question whether the learned symbols in ape projects are actual words that refer to things, or are produced to obtain things only.

meanings, might discover the importance and possibilities of fully exploiting that form of communication and might therefore also have non-acquisitive, intrinsic motivations in using the symbols. One might say that reaching the symbolic level also means going beyond the here and now, and going beyond need gratification only.

To conclude then, on the status of the signs used by the signing chimpanzees: there is no evidence for symbolic grasp of the signs' meaning. However, it cannot be fully ruled out either. Nevertheless, some of the ways in which they use the signs is suggestive of these operating on an indexical level only.

PART III.

THE CHIMPANZEE SIGN USE COMPARED TO THE USE OF LEXIGRAMS BY THE BONOBO KANZI.

An ape that has been in the spotlight in recent years has been the bonobo Kanzi who communicates by way of lexigrams. It may be of interest to relate the findings on his use of these lexigrams to the signing of the chimpanzees. In this part of the dissertation then the work and findings with Kanzi will be examined in some detail.

The bonobo or pygmy chimpanzee (*Pan paniscus*) Kanzi[365] was born on October 28, 1980 at the Yerkes Regional Primate Center of Emory University in Atlanta, Georgia. He was brought to the Language Research Center (established in 1981) of Duane and Sue (Savage) Rumbaugh of Georgia State University, also in Atlanta. There he was adopted by Matata, who was being taught lexigrams by the Rumbaughs. Lexigrams are arbitrary "geometric designs devised by humans to stand for things" (Greenfield & Savage-Rumbaugh, 1990a, p. 546). These lexigrams were arranged on a large board or on a computer screen.

Humans and bonobos pointed to the lexigrams on the board or pressed lexigram keys on the computer screen. Matata was not successful in acquiring these symbols, though. Kanzi, on the other hand, managed to grasp the meaning and use of the lexigrams. He picked up this understanding by being present at the training sessions that Matata was given for more than two years. Savage-Rumbaugh has made much of the fact that Kanzi learned the lexigrams without having been formally trained himself. However, his presence at his mother's training, though it involves some observational learning, may be considered not that different from being directly trained himself. Kanzi acquired lexigrams for foods, objects, activities, locations, and persons. Eventually, he learned more than 256 lexigrams (Savage-Rumbaugh et al., 1998). Besides Kanzi, the Language Research Center has also studied further chimpanzee subjects who acquired lexigrams. These are Kanzi's half sisters Panbanisha and Mulika, and the common chimpanzee Panzee. In this discussion of the research on Kanzi, first Kanzi's use of lexigrams will be presented, after which his comprehension test of spoken English will be examined.

Kanzi's use of lexigrams.

Patricia Greenfield and Sue Savage-Rumbaugh (1990a, 1990b) analyzed a corpus which included all of Kanzi's combinations of two elements in a period of five months, from April to August 1986, when Kanzi was 5.5 years old. The combinations consisted of either two lexigrams or of one lexigram and a gesture. Data were collected for nine hours each day. The total number of utterances that Kanzi produced in these five months was 13,691. Only 1,422 of this total, or 10.39% were combinations of two or more elements. Note that this is far below the percentage of combinations found in the recent corpora of the signing chimpanzees, which was 33%. The overall majority, almost 90%, of Kanzi's lexigram use, then, consist of him using only one lexigram at a time. This compares to the MLU measure that was calculated for Kanzi (given in Savage-Rumbaugh, Murphy, Sevcik, Brakke,

[365] Kanzi is Swahili for "bold and brave."

Williams & Rumbaugh, 1993). At the age of five, he had an MLU of 1.15, which remained the same for at least the three following years, up to when he was eight. Notice the similarity with the MLU data for Nim (presented in 2.2.1.). His MLU too stayed the same during the last 1.5 years of his project.

Further reductions of the corpus took place in order to be able to look at possible grammatical structure, the goal of the 1990a analysis. Only those combinations were used which contained enough context information to be able to determine the probable semantic relation of the combination. Partial and full imitations from the human were also excluded. These consisted of a comparatively minute number of 2.7% of all combinations. In another study a percentage of 6% of immediate imitation is given for Kanzi at 5 years old, and 21% for Mulika, Kanzi's half sister, when she was almost 2 years old (Greenfield & Savage-Rumbaugh, 1990b). These percentages are given for the total of utterances that Kanzi and Mulika made, so both single lexigram utterances and combinations. Kanzi's percentages certainly are much lower than those found for the signing chimpanzees in the recent corpora. Mulika's percentage, however, is very similar. The signing chimpanzees made full and partial imitations in 18% of their utterances from the recent corpora.

To go back to the study on grammar, after exclusion of the abovementioned types of utterances a final corpus of 723 two-element combinations remained. This whole corpus was published as an appendix to Greenfield and Savage-Rumbaugh (1990b). It includes the types of combinations made by Kanzi, together with the frequency with which they were made. All of these combinations were then interpreted for the presence of semantic relations. Ten relations accounted for a high number of 93.5% of all his two-element combinations. A serious problem of this study, however, is that all the utterances came from individual observations and are thus not backed by a permanent record in the form of film or video. This study then suffers from the same problems that the unfilmed observations of the signing chimpanzees have. All the problems mentioned in section 3.1. are also present in this Kanzi

study. It may well be possible to be mistaken about the particular lexigram that Kanzi touches or points to, considering the many lexigrams on his usual board. One may misperceive Kanzi as pointing to the lexigram right next to the one he was actually pointing to. Perception errors may thus occur with regards to the exact lexigrams that Kanzi pointed to on the lexigram board.

Besides these problems, the evidence for semantic relations as given in Table 20.1 of Greenfield and Savage-Rumbaugh (1990a) gives some further cause for worry. One problem concerns the Attribute+Entity category. The combinations that were assigned to this category may not be actual descriptions of the attribute of an entity. The most frequent utterance assigned to this category was FOOD BLACKBERRY.[366] It may not be that appropriate to interpret BLACKBERRY as an attribute of FOOD, since all food and drink items in combination with FOOD or DRINK would then be attributes. However, as was apparent in the signing chimpanzees' utterances, these instances may consist of a request item combined with the general purpose sign FOOD or DRINK. In total Kanzi combined FOOD with objects in 9 instances, as in FOOD BANANA, EGG FOOD and FOOD MELON. Then there were combinations in this category of SURPRISE with BALL, CARROT, or FOOD. The lexigram SURPRISE functions as an announcement that something nice is going to happen (some special object or action). The combinations with SURPRISE may then not represent a surprise attribute of an object. Still other combinations in the Attribute relation were three where AUSTIN was combined with TV, and the gestures "that" and "videotape." The remaining combinations that may also not be that strongly indicative of the Attributive relation are: COKE WATER, GOOD MUSHROOM, and ICE WATER.

Questionable relations are what are called "Conjoined actions," "Conjoined entities," and "Conjoined locations," which comprise 124 of the 723 combinations. All of these can be interpreted as requesting two things at the same time, and therefore need not have any structural semantic connection with each other (which is required to assume a veritable

semantic relation). Greenfield and Savage-Rumbaugh (1990a), however, say that the "Conjoined entities" category was not similar to their category of "No direct relation" since in the former "the entities were linked by a common agent and action." The instances in this category were like the following examples: M&M GRAPE, ORANGE-DRINK MELON, BREAD JUICE and HAMBURGER PEANUT. The obvious common action with these object lexigrams was to give them to Kanzi, which was done by the human as common agent. However, this fact is no justification for the ascription of a semantic relation here.[367]

The corpus does, however, provide a variety of combinations that suggest the presence of the following three semantic relations: Action+object, Location+entity and Agent+action. In 34 combination tokens that are assigned to the Action+object category six action lexigrams (BITE, CARRY, HIDE, HUG, KEEPAWAY, SLAP and TICKLE) are combined with 11 object lexigrams, resulting in a total of 19 types of combinations (34 tokens),[368] with examples such as BITE TOMATO, CARRY BALL, HIDE PEANUT, HUG BALL, KEEPAWAY CLAY, SLAP BALL and BALL TICKLE.[369] Another relation of which there are a variety of types of combinations is Location+Entity. Here locations such as PLAYYARD, GROUPROOM, LOGCABIN, TRAILER and STAFF-OFFICE are combined with several different object lexigrams. Examples are TRAILER PEANUT, FOOD GROUPROOM and STAFF-OFFICE WATER. Finally, the Agent+action category also showed a variety in the semantic roles. Agent was represented mostly by the gesture "you" (124 combinations of a total of 132), but also by AUSTIN, LIZ, MATATA, MULIKA and PENNY. The action lexigrams they were combined with were CHASE, SLAP, TICKLE, BITE, HIDE, CARRY and GRAB. The most frequent combination types were CHASE+you

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[366] Like the signs, the lexigrams learned by Kanzi and other apes are usually represented in capitals.

[367] Another remarkable thing is that the Requesting relation is totally absent, which is strange, to say the least, considering the frequency with which the signing apes combine a request marker to something they want. Maybe the requesting relation is not relevant in Kanzi's productions, since virtually all of his lexigram use is interpreted as requesting objects or actions (see below).

[368] Excluded from this total are combinations in Table 20.2. of an action sign with an "animate object," like GRAB KANZI, since these do not conform to the general object-action relation and might better be called action-patient.

(58 tokens), BITE you, SLAP you, CARRY you and TICKLE you.[370] However, notice the large presence of the "you" gesture in these combinations. The human and chimpanzee name lexigrams were only made in 8 of the 132 combination tokens.

Another frequent type of semantic relation that was considered present by Savage-Rumbaugh and Greenfield in Kanzi's combinations was Demonstrative+Entity. These consisted of 231 sequences in which the "that" pointing gesture was combined with object lexigrams (and once with AUSTIN). Like the combinations with THAT of the signing chimpanzees in the recent corpora, however, these may be examples of the request relation. Most of Kanzi's utterances were interpreted to be requests (see below), so his combinations with THAT may be a combination of objects with a request marker rather than a demonstrative, as was the case with the signing chimpanzees.

Greenfield and Savage-Rumbaugh then present two rules for ordering elements within an utterance that Kanzi supposedly invented himself: placing a gesture after a lexigram, and ordering conjoined actions in a way that the more proximate action was placed before the more distant one. They call these spontaneously invented rules productive "protogrammatical" rules. With "protogrammar" they mean to say that the particular rules were of a "very simple nature" (p. 543). They claim that human children at the age of two similarly make use of only simple rules and that there is therefore no difference between Kanzi and the children, in this respect.

However, the first rule may not be as strong of a strict rule, since there was a considerably limited number of gestures that were used. They consisted of only the pointing gesture to the agent in agent-action, demonstrative+entity, and agent-object relations. This limitation of the expression of the semantic role to the pointing gesture only is comparable to the combinations of the signing chimpanzees in the recent corpora that were candidates for

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[369] Kanzi produced the order action-object more often than object-action, something he probably took over from his human companions.

[370] Notice though, that all these instances did not come from a permanent, filmed record. Conclusive evidence for these three semantic relations is therefore not present until filmed data will be presented.

the Agent+action relation and the two types of Locative relations (discussed in 4.3.4.). Only in what is called the goal-action relation did Kanzi combine four different gestures with an action: the gestures for "go," "come," "chase," and "open." Greenfield and Savage-Rumbaugh (1990a) conclude: "Thus, to a limited extent, that rule involved relations between two categories ...: a larger category of lexigrams and a smaller category of gestures" (p. 560). However, one may question this supposed goal-action relation in itself. It is unclear from what category system they derived this particular relation. It justifies interpreting as a semantic relation sequences like BLUEBERRY come-gesture, MELON go-gesture, ORANGE open-gesture (when Kanzi wanted the cooler in which an orange was kept to be opened). In other systems of semantic relations such combinations might not have been classified as being internally related. Also, the come- and go-gestures appear related to the request markers of the signing chimpanzees. They are useful gestures to make, and add to one's request, but there may be no evidence for actual semantic relations there.[371] If these doubts are correct, then the whole supposed invented grammatical rule is questionable. Without the goal-action relation there would be no variety in the gestures used and no semantic or grammatical structure would need to be inferred. Notice the similarity with the order pattern in the signing of the CHCI chimpanzees in the recent corpora. Like Kanzi, they too combined object and action signs with request markers, and THAT/THERE/YOU.

The second rule, concerning the combining of actions, was only discovered after an analysis of regularities in the first and second position of particular action lexigrams used by Kanzi. It is not then, that the humans themselves already saw a meaningful relation present in such combinations, but they decided there was a structure when they found out certain statistically significant position preferences for five action lexigrams. These were that CHASE and TICKLE were often used in the first position, whereas HIDE, SLAP and BITE appeared mostly in second position, resulting in combinations such as CHASE HIDE and

[371] Of interest here, too, is that Kanzi showed no order regularity when he combined action lexigrams with goal lexigrams.

TICKLE BITE. Greenfield and Savage-Rumbaugh interpret this rule as representing Kanzi's order of actions. CHASE and TICKLE were interpreted as invitations to play, and HIDE, SLAP and BITE as the content of the play that then followed. The absence or general rarity of conjoined actions in children's speech, and the fact that the rule was only found after the fact, was interpreted as being a particular rule of order of pygmy chimpanzees, rather than a human rule of action combinations.

This rule too has its problems. Despite the found preference, the combination may not be internally related in meaning. Kanzi may have been asking for two different actions and the preference may have come about by some idiosyncratic habit. It is also questionable that the humans at first saw no clear semantic relation in this pattern and only later constructed one which then reinterpreted the meaning of the lexigrams CHASE and TICKLE. Obviously, these lexigrams are used to refer to the action of chasing and tickling. Representing them in this rule as "invitations to play" seems a little too constructed. This may be an example of an unjustified rich interpretation. Also, the variety of signs within the pattern is very limited. There are only two different signs in the initial position, and three in the second position.

A further finding on Kanzi's combinations was that 90% were sequences of two elements (Greenfield & Savage-Rumbaugh, 1990b) A further claim that was made on Kanzi's production is that his three-element combinations were, unlike Nim, not redundant, but instead adding information.[372] The only type that is discussed, though, is the combination: action-action-agent, of which the agent was indicated by a demonstrative gesture. In other words, the questionable conjoined actions rule in combination with the gesture of pointing towards someone. In the sign use of the chimpanzees in the recent corpora the usefulness of signing THAT to a person in order to strengthen a request was clear, and THAT was grouped as a general purpose or wild card sign, together with YOU, GOOD and the chimpanzee's name sign. Though there is no element of repetition of redundancy to be discovered in these

[372] Savage-Rumbaugh et al. (1998) claim that Kanzi's use of lexigrams was "generally spontaneous and nonrepetitive" (p. 206).

particular three-element combinations of Kanzi, adding a point to a person may not count as increasing the information content of the two-element combination.

Finally, very useful is the information given on Kanzi's motivation or communicative intentions when using the lexigrams. A huge percentage of 96 of his lexigram utterances are interpreted as requests, comparable to the highest frequency of requests of the signing chimpanzees (in the *1993* corpus), but 10 percent higher than the signing chimpanzees' mean in the four corpora. The remaining four percent are considered to be "indicatives or statements."[373] Most probably these would compare to the different Naming instances of communicative intentions.[374] The percentage is similarly comparable to the signing chimpanzees' lower percentage of 2% in the four analyzed corpora. Also, the absence of any further intentions besides requesting and naming, is found in the same way in the recent corpora of sign use of the chimpanzees.[375] Thus, intentionwise there appears to be no difference in the way signs or lexigrams are used by the pygmy chimpanzee Kanzi and the common chimpanzees Washoe, Moja, Tatu, Dar and Loulis in the analyzed corpora.[376]

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[373] Greenfield and Savage-Rumbaugh, however, do not specify the procedure by which they determined Kanzi's utterances to be requests and statements. In 1987 Savage-Rumbaugh gives the following information: "In order for a usage to be coded as a statement or a comment Kanzi must either make it clear that he is not asking for the object or event (by refusing it if offered), or he must carry out the action on his own" (p. 291). Looking at the examples of Kanzi's utterances, just as when one simply looks at the signing chimpanzees' utterances, there is not much more than little inference necessary to interpret these as an overall high majority of requests with a few namings in between.

[374] An (anecdotal) example of Kanzi's lexigram use that is not interpreted as a request by Savage-Rumbaugh's group is presented in Savage-Rumbaugh et al. (1998): Kanzi

> even touched [the lexigram] "juice" simply to comment on how happy he was that I had given him a very large glass of grape juice, his favorite drink - carefully holding it so that it would not spill while walking all the way across the room to make this comment at the keyboard. (p. 22)

An example of a comment by Panbanisha is published in Savage-Rumbaugh (1990):

> Panbanisha stares at her bath water as it is foaming up very high in the sink, as the teacher has inadvertently poured in a lot of soap. It has made a very tall pile of bubbles, not the kind one blows from the bubble jar, but small foamy bubbles. Panbanisha looks at this large pile of soapy foam and comments "bubbles." (p. 226).

[375] Kanzi has also been seen to privately use the lexigram board when others are not present, "particularly at nap time or other quiet periods of the day" (Savage-Rumbaugh et al., 1998, p. 50). Indeed he will choose to be alone by moving away from others, picking up the keyboard, and turning his back. Though this behaviour has not been systematically studied, Savage-Rumbaugh describes the glimpses that she has been able to catch of it: "I frequently see him pointing to the lexigrams "good" and "bad." He also talks about his "ball," his favorite foods, places he likes to go, and about tickling, chasing, grabbing, and biting" (p. 52).

[376] Savage-Rumbaugh (1987) interprets the predominance of requests in Kanzi's utterances as a consequence of the particular mode of communication the board of lexigrams invokes: "To use the keyboard, Kanzi must stop what he is doing, move across space to the keyboard, and touch a symbol. This requirement prohibits the kind of commenting typically seen in children who generally comment on an action or an object while engaged in active

All in all, then, the evidence for Kanzi's semantic and grammatical structure is not convincing or strong. There are quite a few problems with the analyses and conclusions of Greenfield and Savage-Rumbaugh in this respect. Nevertheless, there appear to be some semantic relations, though. It is unclear, however, to what extent these are present in his combinations. His main use of lexigrams was limited to 1-lexigram utterances. Also, the data on Kanzi's production are derived from unfilmed individual observations, which carry the same reliability problems as mentioned for the signing apes. The evidence for meaningful structure in his combinations is not stronger than that presented by the Gardners and Fouts for the signing chimpanzees. A similar conclusion is then appropriate for further research of Kanzi's production: It is necessary to redo the analyses by using videotaped material only, in order to obtain conclusive data.

Comprehension test.

Sue Savage-Rumbaugh's team did a further, very fascinating study on Kanzi's language abilities, this time not looking at his production, but his comprehension.[377] This was done in the form of a large, comprehensive test to determine his understanding of spoken English. Consistent use of videotaping was part of the study. Almost the whole procedure was filmed, including Kanzi's complete reactions. Also, the full corpus of more than 600 trials was published. The publication of the study thus covered a whole issue of the *Monographs of the Society for Research in Child Development* (1993).

Kanzi,[378] who was eight at the time of the study, was presented with 660 short English sentences, which requested him to carry out a particular action. The research question of the

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behavior, such as saying "down" while falling down. .... Certainly if children had to walk across the room and then search among several hundred printed words each time they wanted to make a comment, their comments would become considerably less frequent" (p. 291).

[377] It is interesting that the majority of ape language research has been centered on production rather than comprehension. This situation leaves the field with little data on the apes' comprehension of words, signs or other symbols. Information on comprehension would have greatly improved our understanding of chimpanzee symbol use in general. Future studies on ape language should include many more comprehension analyses.

[378] The study was set up for Kanzi and a human child of two years old, called Alia, who was presented with the same sentences in the same setting. Only the tests and results that regard Kanzi will be discussed here.

study was whether Kanzi could comprehend novel (English) utterances. The exact sentences used were novel in that they had never been presented to Kanzi before. They were composed by combining objects, actions, locations, and persons (not all in every sentence) in some sort of request. The structure of the sentences was varied in a systematic way, resulting in 13 different sentence types. Some examples were: "Go put some soap on Liz," "Give the lighter to Rose," "Knife the sweet potato," "The surprise is hiding in the dishwasher," "Take the snake outdoors," "Go to the refrigerator and get a banana." In the test situation, the objects named in these sentences were placed in a group in front of Kanzi, but objects in other places, as well as humans, could also be part of the test sentences (as can be seen from the examples).

The main part of the test was carried out under blind conditions, excluding any cueing from the principal investigator, Savage-Rumbaugh. She presented Kanzi with the sentences by speaking from behind a one-way mirror. Of the test sentences 244 were presented under nonblind conditions, while the remaining 416 were given in the blind manner just mentioned. The study took altogether nine months to carry out all the 660 different trials, starting in May 1988 and ending in February 1989. All trials were videotaped (except 60 of the nonblind ones).

Kanzi demonstrated understanding of the sentences in a high percentage of 72 for the total of 660 trials, and of 74 for the blind ones only.[379] Kanzi not only demonstrated comprehension of the words and the semantic structure of a sentence, but also of the syntactic

[379] Kanzi was not as successful with sentence types of the conjunctive form "Give object X and object Y to animate A." He performed worst on these sentences, responding correctly in only 33% of their total. His common error in this type was to give only one of the two objects mentioned. Savage-Rumbaugh et al. 1993 speculate that possibly "short-term memory limitations on the overall amount of information" (p. 85), may have been responsible for his little success with this sentence type. This is because the type of sentence "required that he keep two items in short-term memory while he looked around and decided which ones he was supposed to give" (1998, p. 72-73). However, in the other sentence types there are always at least two words to keep in mind as well. Savage-Rumbaugh et al. say it may well be that the structural relations between the words may help Kanzi in the other types of sentences. Thus "Feed the doggie some milk" would be easier than "Show me the doggie and some milk." Nevertheless, it is somewhat striking that keeping two items in mind would be too hard for a bonobos short-term memory abilities.

structure.[380] He paid attention to the specific place of a word within a sentence. Comprehension of this syntactical device of word order was demonstrated by his correct responding to sentences with the same words, but presented in reversed order. For example, "Put the hat on your ball," and "Put the ball on the hat;" "Pour the Coke in the lemonade," and "Pour the lemonade in the Coke;" and "Liz is going to chase Kanzi," and "Kanzi is going to chase Liz." Kanzi correctly responded to 29 of 44 pairs of sentences where both possible orders were presented (which amounts to a correct percentage of 66). However, a more realistic number here may be 8 out of 21 (with a less impressive percentage of 38), since, as Tomasello (1994) has pointed out, not all sentence pairs were perfect reversals. In some cases the difference between the two sentences in a pair is trivial ("*your* ball" versus "*the* ball," as in the first example above). Others, such as "put the rock in the water" and "pour the water on the rock," are treated as equivalent, whereas the difference in verbs between the two sentences is more important, and crucial for the correct response. Semantic understanding of "pour" could indicate that one needs to do something with the water rather than the rock, and thus successful responding to this particular pair does not need to be explained by inferring syntactic grasp. Then there are pairs with different prepositions. In the one sentence "on" is used ("put some water on the carrot"), whereas the other carries "in" ("put the carrot in the water"). Tomasello says that if one only counts perfectly reversed sentences, then Kanzi is correct on only 5 of 12 sentence pairs. He says that this is not different from chance. If one carries importance to the imperfection of the test sentences in terms of being actual reversals of each other, then it has not been demonstrated at all that Kanzi has grasp of the syntactical

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[380] The developmental linguist Elizabeth Bates (1993) says that she is convinced by the comprehension test (which she calls a "ground-breaking investigation") that Kanzi "is capable of language comprehension that approximates (in level if not detail) the abilities of a human 2-year-old on the threshold of full-blown sentence processing" (p. 223). Savage-Rumbaugh herself and her group (1998) conclude after all their work with Kanzi that he has acquired language:

> Kanzi made it increasingly difficult to draw any sort of line between humans and apes that was based on language alone. Certainly, most humans understand more complex language than does Kanzi, but there no longer can be said to exist any real differences between the way Kanzi learns and employs language and the way we do the same thing. (p. 206)

And: "Given the overwhelming weight of the evidence, the conclusion that apes have a capacity for language can no longer be evaded" (p. 206).

device of word order. All that would have been demonstrated by the 1993 test would be semantic understanding of the different English words present in the trials.

Actually, in the three tables (8A-8C) that Savage-Rumbaugh et al. present of the three different subtypes of reversed sentences, test sentences from the non-blind conditions are not excluded from the list. Non-blind sentences should have been left out of the analysis, though, since cueing can then account for Kanzi's responses on these trials. Of the eight more perfect reversals of sentence pairs, two were from the non-blind trials. The net result then of Kanzi's correct responding to reversed presenting of sentences is 6 out of 19 pairs. He was correct on only 32% of the total trials.

Tomasello's conclusion is that, though "one could certainly wish there had been a more systematic corpus" of more perfectly reversed sentence pairs, "it would nevertheless seem highly plausible that Kanzi knows some ordering patterns for at least some of his action words" (p. 382). Kanzi uses the syntactic structure of the sentence to determine its meaning, even though this may be limited to certain individual (especially action) words only.[381]

Recursion in the form of embedded relative clauses was also tested for comprehension. Recursive sentences were presented by using the phrasal modifier "that's" to clarify which of two objects was to be retrieved by Kanzi. Examples were "Go get the carrot that's in the microwave," and "Go get the stick that's outdoors." Kanzi was again successful in understanding the requested action of these particular sentences. Savage-Rumbaugh et al. interpret this as that Kanzi is "capable of interpreting the syntactic device of recursion appropriately" (p. 90). Tomasello (1994), however, has offered an alternative explanation for his success on these particular trials. This is that Kanzi, through his previous experience with similar sentences, expects the thing that he is asked to "get" to be mentioned first, which is then followed by the mentioning of the location. Such a rule learned from experience makes it unnecessary to invoke "knowledge of recursive sentence embedding" (p. 384).

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[381] Tomasello speculates that this limitation to individual words may be the result of the fact that Kanzi has not yet obtained the grammatical category of verb.

Conclusion on Kanzi.

In the case of Kanzi, the following things were found: a high percentage of 1-lexigram utterances; semantic structure in his combinations in the form of semantic relations; a few preferences in lexigram order, though these may not necessarily be evidence of syntax; and a similar acquisitive motivation as the signing apes in the recent corpora, in using his lexigrams. However, these results were not taken from a permanent record. A future study using film or video, with publication of the corpus, is necessary to confirm these findings. In comparison then, there are no reliable reports that Kanzi's use of lexigrams goes beyond the sign use of the chimpanzees in the recent corpora. As for his comprehension, in a study that filmed almost the whole procedure, it was demonstrated that Kanzi understood a considerable amount of individual English words. There is also some suggestion that Kanzi may comprehend some grammar, in the form of understanding pairs of sentences with reversed word order. The work with Kanzi shows that more can still be learned from the great apes, with regards to their linguistic competence and abilities. The book should not be closed and new discoveries may still occur.

PART IV. SUGGESTIONS FOR FUTURE RESEARCH.

The nature of this study has allowed for an in depth analysis and comprehension of the phenomenon of the chimpanzees' recent sign use when they are in relaxed, natural "conversations" with their human caretakers and companions, confined as they are to the compounds of their spaces in the CHCI. Obviously, the patterns and regularities found in the analyzed corpora, do not imply that the chimpanzees never use the signs in other, maybe more complex ways. It is strongly recommended that a study like this one should be executed

on a yearly basis or so, collecting a substantial corpus of sign interactions between the chimpanzees and the humans under relaxed and naturalistic conditions, preferably without prior structuring of the human sign use. Such an annual sample would provide valuable and precious material on the nature of the continuing sign use by the only chimpanzees at a university in existence that still use human taught signs on a daily basis. This of itself would justify the effort and means to carry out such a regular study. At the same time, it would give the possibility for the detection of further use of the signs by the chimpanzees that may go beyond the phenomena that were found in the analysis of the present corpora.

Of utmost importance, as was already mentioned above, is the systematic analysis and publication of older corpora of sign use by these chimpanzees. If such corpora exist, preferably filmed or videotaped, their analysis would provide for invaluable material with which to compare the recent signing, but also with which to assess the reports and claims about their earlier sign use.

Other studies that should be carried out would be additional double blind vocabulary tests. However, this time not only of object signs, but also of the other semantic categories in the chimpanzees' reported vocabularies.

In this chapter it was already suggested that a study focusing on Tatu's naming behaviour would be of importance. It might show more clearly that her interest in naming may be intrinsically motivated. A further analysis of her use of the sign BLACK might also shed more light on this intriguing behaviour. Also of interest would be a future study on the chimpanzees' pointing behaviour. Its status as an actual symbol or as an indexical performative can be analyzed. The chimpanzees' use of pointing can then be compared to the declarative and imperative pointing behaviour of human children.

Future analysis could look at additional aspects of the signing, such as a more detailed investigation of the discourse. An extensive analysis could be made of the human side of the

conversations, for example. Also useful would be to see if there are differences between utterances that are made in the beginning of a session versus towards the end of it.

Obviously there are many more analyses to be made of the corpora used in this study. The data in this dissertation should not therefore be taken as exhaustively representing all the multitude of aspects of the sign behaviour of the chimpanzees. They are merely the main important findings that together form a clear picture of the major patterns and regularities of the chimpanzees' recent sign use in the four analyzed corpora. The same holds for the discussion and conclusions of the material in this study. More implications of the results can be made, and comparisons with other studies on "language" in animals will be useful to make. Though the chimpanzee sign behaviour has been compared to the lexigram use of the bonobo Kanzi, comparisons still have to be made with the results of the projects with other signing apes. It will be interesting to see in what way the

sign use in the recent corpora is similar or in contrast to the findings on the signing gorillas Koko and Michael, and those on the signing orangutan Chantek. In a similar way as has been done in chapter 3, the methodology and interpretation used in these other projects will also have to be assessed. The conclusions in this dissertation will therefore not be the last word on ape language and future work will enable an even better picture of the exact nature of ape sign behaviour.

EPILOGUE

In this last part of the dissertation I will make several personal remarks regarding the results of this study. I will link back to the original goal of this study by discussing its implications for the subject of animal consciousness. The moral aspects of this type of research with apes will also be presented. Finally, I will assess the moral implications that the results of this study may have.

The original goal of this study was to learn more about the consciousness of the signing chimpanzees by analyzing the information in their sign utterances. Two particular communicative intentions are the most relevant for this research topic: Internal state reports and Attributions of internal states to others. Though the researchers of the projects had mentioned several examples of such internal state related communications in earlier publications, in the signing in the recent corpora none of such instances were found. Though the chimpanzees may have signed about internal states in earlier times, the results of this study do not confirm the suggestion that these chimpanzees are still communicating in signs about their feelings, emotions and other internal states. In effect then, with regards to signed internal state expressions, no new data were obtained. Indeed, one may interpret the results as negative findings, or a form of falsification of the hypothesis that the chimpanzees sign about internal states. In science such studies occur frequently: one sets out to find something, and after meticulous study and analysis one has to come to the conclusion that the thing that one sought for is not there. I personally regret the fact that no sign utterances were found in which the chimpanzees were communicating about internal states. It would have been fascinating and interesting to have obtained results that showed that the chimpanzees signed that they felt

happy or sad, or what they thought was funny or cool. Such findings would have meant genuinely new knowledge on the internal states of another animal species. New studies in the future may still obtain sign utterances of apes about internal states. Also, other language studies with apes in the time to come may provide instances of explicit internal state communications. However, with the knowledge that we have now, these five signing chimpanzees do not appear to sign about their internal states or those of others.

For the study of phenomenal consciousness in animals then, it seems that the signing apes will not provide us with an additional avenue of information that is of interest. It has not yet been possible to open up a new window on the chimpanzees' inner mind by studying their signing behaviour. It seems that the field of research on animal consciousness will have to remain limited to the study of nonverbal behaviour and the nervous system of other animals.

Though this study may not have found verbal references to internal states, the results nevertheless have implications for, and therefore new knowledge about, the communicative intentions and motivation of these chimpanzees. It appears that they have no interest in communicating about internal states through signs, even though they have some signs in their vocabulary that in humans refer to internal states. Obviously, the chimpanzees communicate about internal states through nonverbal means, their nonverbal behaviour, postures and vocalizations. It appears that these nonverbal ways suffice for their communicative goals. The difference between such nonverbal communication and the explicit verbal expression of internal states lies in the degree of specificity of communication. It is possible to make clear inferences about the internal states of chimpanzees by studying their nonverbal behaviour. However, verbal communication would have provided more specific information, such as what exact state the chimpanzee was in (for example, SAD or ANGRY), their evaluation of certain events or situations (e.g., FUNNY MAN or YOU DIRTY), and explanations for having certain internal states (as for example, ME HAPPY GOOD FOOD, or ME HURT PAIN IN BELLY). Human children quickly start to communicate about internal states once

they have acquired internal state terms. By the time they are 2 years old they have multiple internal state terms in their vocabulary and make sentences in which they express how they feel or what internal states they ascribe to others. There seems to be a difference between humans and chimpanzees in the degree of specificity of communication about internal states. The chimpanzees can communicate their internal states through nonverbal means, whereas humans use explicit terms and more specific information in their references to internal states.

Related to this, there appears to be a difference in the communicative intentions when using signs or other forms of symbols. In this study it was found that the chimpanzees' intentions were mostly limited to requests for objects and actions, with some naming of objects and pictures. Their consistent focus on requesting is in contrast to the multiple and varied communicative intentions that humans have. Humans do not only communicate verbally about internal states, they also talk about the possessions of objects, they request information by asking specific questions, they protest, apologize, make evaluations and give explanations. Through the course of their language development, human children verbally express all of these communicative intentions. Humans thus use their language for a wide variety of communicative goals. Obviously, one has to be careful when making conclusions about the differences between animal species. The projects with signing chimpanzees may not have shown the chimpanzees' full potential for acquiring linguistic skills or the full range of their symbolic communicative intentions. However, if one considers the results of this study to be representative of what signing chimpanzees generally do with the signs that they learned, then one can conclude that signing chimpanzees are not motivated to communicate a wide variety of intentions. Instead they have only a limited motivation in that they mainly utter requests and, to a lesser extent, name objects and pictures. Indeed, it was concluded that the general motivation of the signing chimpanzees in the four corpora can be called acquisitive in nature. In this sense then the results of this study may have provided new information on chimpanzee mind and motivation.

Besides the high percentages of requests that were found, I think that one other result is of importance here. This is the order pattern that was found in the two- and three-sign combinations. Most of the times the chimpanzees consistently put signs for requested objects and actions in the initial position of a combination, while request markers and the signs THAT/THERE/YOU and GOOD were used in the final position. As was described in the previous chapters, this pattern clearly shows the chimpanzees' major motivation for using signs. Their focus is to communicate requests for objects and actions, for which they use specific object and action signs. Other signs are mainly used to get these requests fulfilled. Thus, their acquisitive motivation is combined with a manipulative orientation towards the humans in having them oblige to the chimpanzees' requests. It seems that once chimpanzees learn symbols in the form of signs, they limit the use of this means of communication to the service of an acquisitive motivation. Though the researchers of the projects had hoped that the apes would communicate multiple communicative intentions, the chimpanzees have not realized the full potential of signing. Instead they seem to give the message to the researchers that they are mainly interested in obtaining desired objects and activities and are not motivated to communicate about other subjects (though, again, future research may show an additional interest in communicating about other things). It seems then that the researchers' expectations were beyond the actual interests of the chimpanzees. Human children developing language, however, soon express a wide array of different communicative intentions which increases as they grow into human adults (who also have indirect ways of expressing their intentions and communicate their imagination and fantasy in verbal utterances). Thus, besides a possible difference between chimpanzees and humans in that humans have a higher degree of specificity in communicating about internal states, there also may be a species difference in the variety of communicative intentions that are expressed through the symbolic channel.

These speculations have to be taken for what they are and not as solid facts. We do not know what exactly happened in the early years of the projects. It may well be that the reported instances of internal state communications as well as other types of communicative intentions did indeed occur. Future research may provide instances of a wider variety of intentions than were found in this study. Also, in theorizing about the results, one should not forget the living conditions of the signing chimpanzees in the years in which the four corpora were collected. As was mentioned in the Discussion chapter, the chimpanzees' captive condition may have depressed a varied use of signs. Being housed behind bars and not being their own masters of their destiny or, indeed, their day to day living, it should come as no surprise that their communicative intentions are limited to requesting objects and actions. Chimpanzees who have learned signs but are living in freedom might communicate a wider variety of intentions.

This then brings us to the moral side of the projects with signing apes. Several issues are of importance here. First, there is the fact that the ape subjects had to participate in these projects even if this was not of their own free will. They were not asked for their consent to be the experimental subjects of the projects. The apes were subjected to sign lessons and even though they were not behind bars in the early years, they were under the full control of the humans leading the experiments. This is not to say that these humans treated the apes badly, it appears as if quite the contrary was the case. However, the ape subjects had no choice but to start making signs in order to fulfil their human companions' desire to do so.

The second issue is that once these apes grew older their physical strength called for a full captivity. It is estimated that adult chimpanzees are five to eight times as strong than humans. In order to prevent casualties among both the humans and the chimpanzees the signing chimpanzees were locked away in enclosures behind bars and glass.[382] This robbed

[382] An example of the problems that can arise is the biting by chimpanzees of humans. Washoe has been reported to have bitten the finger of the scientist Karl Pribram from Standford University who came to visit her in Oklahoma. "For unclear reasons, Washoe bit and damaged Pribram's finger; it had to be amputated" (Peterson & Goodall, 1993, p. 222).

the chimpanzees even more of their autonomy and made them almost totally dependent on the human caretakers.

The third problem is that there have been all kinds of moral problems concerning the way in which the chimpanzee subjects were obtained, the kind of treatment they received while in the projects (which included multiple moves), and the question of where to bring the apes at the end of the projects. Recall that Washoe was collected in the wild by the Air Force. In the 1950s and 1960s chimpanzees were still being imported from Africa for space and medical research (Fouts, 1983b).[383] The Air Force obtained the chimpanzees from African hunters who usually killed a mother chimpanzee in order to capture an infant. Many infants died in the capture and in the subsequent transport to America: "It is estimated that ten chimpanzees died for every one that made it to this country [the USA]" (Fouts, 1997, p. 43).[384]

Washoe and the chimpanzees of the Gardners' second project had to move several times. When the Gardners decided to end Project Washoe after 4 years Washoe had to go someplace else. Fouts (1997) mentioned several reasons for this decision. One was that a new shopping centre was going to be built across from where the Gardners lived, which would end their safe seclusion. Another reason was that Washoe was getting bigger and stronger. Furthermore, several members of the Gardners' research team were graduating and leaving the project, including Susan Nichols. Roger Fouts also had planned to leave in order to work with children. Washoe would therefore have to adjust to a new family of new graduate students, something she might well resist. The Gardners therefore decided to send Washoe to the Institute for Primate Studies (IPS) in Oklahoma. Fouts himself, however, thought that the

[383] Fouts (1997) describes how chimpanzees were launched into space as chimponauts before humans were sent into space. Famous is Ham, short for Holloman Aeromedical, the first chimpanzee who, in a capsule on top of a rocket, made a voyage beyond the earth's atmosphere. This experiment took place in 1961.

[384] For further information on the capture and trade in feral chimpanzees see the excellent book *Visions of Caliban. On chimpanzees and people* by Dale Peterson and Jane Goodall (1993) on the many forms in which humans use chimpanzees for their own interests.

move to Oklahoma would ask a much bigger adjustment of Washoe and he felt that the solution was worse than the problem:

> But the Gardners kept their motives to themselves. It never occurred to me to ask why *they* weren't going to Oklahoma with Washoe. "Washoe," Allen Gardner would always say, "belongs to science." It was hard not to feel that this lofty sentiment was, on some level, a convenient way of evading the responsibilities of foster parenthood. But Washoe had never been a full-fledged Gardner family member; she was part stepchild and part research subject. (p. 112)

Washoe was thus sent to Oklahoma, while she had bonded with the Gardners and would not see all the participants of Project Washoe again.

While in Oklahoma, the Fouts encountered multiple problems that concerned the welfare and safety of the chimpanzees. The Institute for Primate Studies had certain management problems, which included delays in building a larger enclosure for Washoe. Ignoring the Fouts' original design, the new cage was built out of dangerous and unsafe expanded metal with razor-sharp edges. Washoe's second infant, Sequoyah, cut his toe on it, which got infected. This infection was a factor in his premature death (see Fouts, Hirsch, and Fouts, 1982, as well as Fouts, 1997, for a more extensive description of these problems). The Fouts did not like the management of the IPS by Lemmon. They felt as if they were jailors keeping the chimpanzees imprisoned. People at the institute treated the chimpanzees with electric cattle prods, pellet guns and even real, loaded guns. The Fouts therefore went looking for a better place. Another major reason to leave Oklahoma was the fact that Lemmon was starting to sell the IPS chimpanzees to biomedical laboratories for research. He even threatened to sell Washoe, claiming, unrightfully, that she was his property.[385]

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[385] Keeping his moving plans secret for Lemmon, Fouts eventually left with Washoe, Loulis, and Moja in a double-long horse trailer before dawn on the morning of August 25, 1979 (Fouts, 1997; Peterson & Goodall, 1993).

At first Roger Fouts had hoped to be able to send Washoe back to Africa. He wrote for information to Jane Goodall, who advised against this idea. She said that Washoe would not survive in the jungle, wild chimpanzees would kill her, and she would certainly miss the world she got used to in the US.[386] Lucy, the signing chimpanzee raised by the Temerlins, had been sent by her foster parents to a chimpanzee rehabilitation project in the Gambia, Africa (though she was born in Florida). One of Fouts' graduate students, Janice Carter, went with her. In Africa, Lucy became depressed, emaciated and seriously ill. She eventually adapted somewhat to life in the wild, but after some time was shot and skinned by poachers. Her hands and feet were cut off, probably sold on markets as trophies (Fouts, 1997).[387]

Rehabilitation to Africa being risky business, the Fouts wanted to create a sort of sanctuary with "very little human intrusion" at a university. Central Washington University (CWU) in Ellensburg, Washington, offered Fouts a primate facility on the third floor of its Psychology building. This contained four caged rooms built to house monkeys, but as there was no research going on with monkeys, the chimpanzees could move in there. These housing conditions would definitely be better than those in Oklahoma. The Fouts would also have full freedom in the care of the chimpanzees. They therefore decided to move to Ellensburg.

The chimpanzees of the Gardners' second project were all separated from their mothers only one or more days after birth. After several years, at the end of this project, they too were sent to the Fouts. Moja had grown and in 1979, when the Gardners decided to move her to the Fouts, she was 7 years old. Fouts (1997) says that the Gardners experienced strange behaviour from Moja. For example, she bit people for no apparent reason. She also showed auto-mutilation behaviour. Some assistants described her as "a neurotic tyrant." Because of all this, Moja was sent to the Fouts, in the hope that she would fare better with them. After a year, Moja was well integrated into the group with Washoe and Loulis and her self-mutilation

[386] Fouts' dedication of his 1997 book is therefore "For Washoe and all the other chimpanzees who can never go home again."

behaviour stopped, though "Moja would always be rather neurotic and eccentric" (Fouts, 1997, p. 251). With Tatu and Dar, too, the age and strength of the chimpanzees were the reasons for sending them to the Fouts, who were by that time in Washington. Also, the Gardners' funds for doing research with the signing chimpanzees was running out at that time. According to Fouts (1997), he at first protested to this transfer, because they were already having financial problems taking care of Washoe, Moja and Loulis. However, in response to this protest Allen Gardner threatened to send them to a zoo. The Fouts feared that Tatu and Dar might eventually end up in a biomedical laboratory and therefore agreed to take care of them.[388]

The chimpanzees' new home in Ellensburg had its own problems. The rooms were not too big, and especially lacking was an outdoor area. The president of CWU was, however, encouraging about the possibility to build an outdoor facility in the near future. This promise was not kept, though, and the result was that for 13 years the chimpanzees had to live in a limited space on the third floor of the Psychology building, never being able to go outside. They were thus never exposed to sunlight, which eventually led to certain health problems in the chimpanzees. Tatu and Moja suffered from rickets, a bone disease caused by lack of vitamin D. From 1985 onwards the Fouts started to raise funds to build a new facility with an outdoor area, which eventually was completed in 1993. The new building was christened the Chimpanzee and Human Communication Institute or CHCI. On May 10, 1993, the chimpanzees first set foot in the outdoor enclosure of the CHCI.

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[387] See the first part of chapter 10 of Peterson and Goodall (1993) for an extensive description of Lucy's story.

[388] Fouts (1997) explains their reasoning:

> I knew that a zoo wouldn't take Dar and Tatu. Zoo directors think that home-reared chimps act too human. It's bad business for zoos if their chimpanzees dress up in clothes, talk in sign, and leaf through magazines. It tends to unnerve the visitors, who expect dumb beasts. But if the Washington Park Zoo [to which Allen threatened to send them] wouldn't take Dar and Tatu, I knew who would: a biomedical laboratory. Allen and Trixie had gotten all their chimps, except Tatu, from such labs, and unlike me, they were comfortable in both the behavioral and the medical research worlds. They spoke highly of certain biomedical researchers, like the ones conducting hepatitis research, who claimed to have the chimpanzees' best interests at heart. Besides, Allen was always saying that the chimps belonged to science. (p. 265)

Terrace also mentions several welfare problems of Nim that were caused by the conditions of Project Nim. Nim was born at the Institute for Primate Studies in Oklahoma. He was separated from his mother when he was only two weeks old. His mother was shot with a tranquilizer dart by Lemmon in order to take Nim from her. During the project Nim had increasing difficulty with the "revolving-door manner" in which changes of staff occurred and his emotional reactions to these changes intensified. Nim had to go through a series of emotional attachment to one person, who then left to be replaced by new people.[389] Like the chimpanzees in the Gardners' projects, Nim too was sent away after several years, four to be precise. This decision was taken because of financial problems. Nim was moved back to Oklahoma, though Terrace (1979a) mentions that this was done with "great reluctance." There he had to be confined to a cage, whereas he had been living with humans in houses up to that time. He initially fell into a depression, but eventually learned to live in this new place.[390]

Eventually, in 1982, Lemmon sold his entire chimpanzee colony to the biomedical laboratory LEMSIP,[391] owned by New York University (Fouts, 1997; Linden, 1986; Peterson & Goodall, 1993). This included Nim, Booee, Bruno, Cindy, Thelma and Ally. All of them were to be used in hepatitis research. This news caused a public outrage, with a special concern for the signing chimpanzees' fate.[392] Apparently the public was less upset with the fact that non-signing chimpanzees had been sold. Fouts describes what happened then: "This gave New York University and Lemsip a public relations opportunity that it quickly seized. They sent Ally and Nim, their two best-known chimps, back to Oklahoma, and the uproar

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[389] Terrace: "The sheer frustration of losing a caretaker with whom he felt close and having that caretaker replaced by a new person was sufficient to evoke Nim's anger and aggression" (1979a, p. 97).

[390] Chapter 12 of *Nim*, "Nim Leaves," describes in great detail the events and feelings that took place during and shortly after the transfer to Oklahoma.

[391] LEMSIP is an abbreviation of Laboratory for Experimental Medicine and Surgery in Primates.

[392] Dale Peterson has given his account of Terrace's role in this situation. Terrace

> lent his authority to the protest. Both Dr. Moor-Jankowski and Dr. Mahoney of LEMSIP have insisted to me that Terrace was fully aware of Nim's pending sale to the laboratory months before it was completed and publicized, but the psychology professor has insisted that the news shattered his peaceful sleep one night in May 1982, when a television correspondent delivered it by telephone. Terrace soon placed himself in front of several television cameras,

immediately died down" (1997, p. 285). Wanting to get rid of Nim again, Lemmon then sold him to the Fund for Animals, an organization run by the popular writer and animal advocate Cleveland Amory. In 1983 Nim went to live on Amory's Black Beauty Ranch in Texas, where he was housed well, together with several other chimpanzees. He died there from a heart attack at the age of 26 on March 10, 2000.[393] Ally, however, had another fate. Lemmon wanted to send him to a place where no one would ever find him. This appears to have been the White Sands Research Center in New Mexico, a private laboratory testing drugs, cosmetics and insecticides on animals. It is unknown what happened to him there. Fouts refers to one source that informed him that Ally had died in a toxicity study after being injected with insecticides. The story of Booee is an altogether different one. He had remained at LEMSIP and was infected there with hepatitis C. In 1995 Fouts visited him there, which was broadcast in the ABC *20/20* program. The televised visit provoked people to send donations for a better home for Booee, which was eventually found in the non-profit Wildlife Waystation in California. Booee and eight other chimpanzees were allowed to go to this sanctuary (sadly, Bruno had already died while at LEMSIP).

It is here that attention should be drawn to the love and dedication that the Fouts, their staff, students, and volunteers have given to the five chimpanzees for decades. The Fouts decided not to leave Washoe or the other chimpanzees with someone else, but kept true to their commitment to ensure their welfare by staying with them. They could have abandoned the chimpanzees and sent them off to some laboratory, as the director of the IPS in Oklahoma did. Instead, they tried to find the best place for the chimpanzees. In 1973 Fouts rejected an offer by Yale University to become an assistant professor, because he did not agree with the living conditions and treatment the chimpanzees would be offered there. Now at the CHCI the humans let the chimpanzees' interests come first, and all of them are trying to make each

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> protesting the morally outrageous treatment of his famous chimpanzee, and threatened litigation against various responsible parties. (Peterson & Goodall, 1993, p. 226)

[393] The life-expectancy of feral chimpanzees is into their late 40s. In captivity chimpanzees have been known to live beyond the age of 60.

new day interesting and enjoyable for the chimpanzees. Enrichment is an integral part of the caretaking of the chimpanzees. In the multiple visits that I paid to the CHCI in the 1990s I have been personal witness to the atmosphere of love and care that exists in that building. There are strong bonds between the chimpanzees and their human companions. In the videotaped corpora there are many delightful instances of the expression of these relationships. The humans and chimpanzees enjoy playing chase together, the humans brush the chimpanzees through the bars, they give them all attention, supply them with foods, objects, and more. For most of the students and volunteers at this laboratory, to work with and take care of these chimpanzees has been an incredible experience from which they have learned a great deal. When Moja died recently at the age of 29 everyone at the CHCI was devastated. A memorial service was held in which many people spoke a few words about this wonderful chimpanzee.

The Fouts deplore the fact that the chimpanzees are in captivity and, indeed, they deplore this of all captive chimpanzees.[394] They have spoken out many times for a better treatment of captive chimpanzees and for the protection of the habitat of feral chimpanzees in Africa. In 1986 Fouts wrote to a congressional committee to oppose new plans for a breeding program for experimental chimpanzees. Jane Goodall asked him in 1987 to visit the biomedical laboratory Sema where HIV-infected chimpanzees were kept . They inspected the chimpanzees' living conditions and were shocked by what they experienced there. They made recommendations to improve the fate of these chimpanzees (Fouts, 1997; Peterson & Goodall, 1993). Fouts was also on a USDA panel of primate experts for new rules on the care of captive chimpanzees. He has also been a member of Psychologists for the Ethical Treatment of Animals and Debbi Fouts is still a board member of this organization. In 1991 Fouts took part in a lawsuit by the Animal Welfare Institute and the Animal Legal Defense

[394] After Moja's death, the following quote by Roger Fouts was put on the CHCI's website (http://www.cwu.edu/~cwuchci/main.html): "Chimps don't belong in captivity, period. Not even in a facility like this (CHCI). Captivity is not good for them. Our species has yet to learn that lesson, not only with chimps but with any species."

Fund against the government for failing to uphold the Animal Welfare Act, which asks for the protection of the psychological well-being of nonhuman primates. The government had not come up with good standards to do so. It not even demanded larger cages.[395] More recently Fouts had been part of a group of concerned scientists that set up the National Chimpanzee Sanctuary System, in order to create retirement homes for chimpanzees that are no longer used for research. Also, Roger and Debbi Fouts are on the board of the Great Ape Project, which will be described below. Together with the Animal Legal Defense Fund the Great Ape Legal Project has been set up, which will organize court cases to get recognition of the rights of nonhuman great apes. Recently, the Fouts and Friends of Washoe have become part of a newly set up organization and think-tank called the Chimpanzee Collaboratory. This is a cooperation of attorneys, scientists and organizations such as the Jane Goodall Institute to improve the welfare and upgrade the legal status of great apes.

Because of their moral rejection of captivity, the Fouts also have a rule that no new chimpanzees should be born at the CHCI. Up to now no full sexual intercourse has been observed between the five chimpanzees. However, should this be noticed, the Fouts will put the female chimpanzees on birth control. Experiencing daily what it is like for a chimpanzee to lead a captive life, they do not want another chimpanzee to be born and live a life span of about 50 years in captivity.[396]

Despite all the tender love and care at the CHCI the impression remains that the chimpanzees are not fully happy with their captive condition. Subjectively, it seems that the

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[395] All of this information can be read in great detail throughout Fouts' 1997 book, especially chapter 13 "Monkey Business." Deborah Blum's book *The Monkey Wars* (1994), also has some information on Fouts' political work.

[396] These are Fouts' (1997) thoughts on research with animals:

> I knew that trying to draw a clear moral distinction between a biomedical experiment and a language experiment was a losing proposition. As horrific as many biomedical labs were, the underlying problem was captivity; captive environments differed only by degree of their cruelty. The humane solution, in my mind, was to work toward the gradual termination of *all* research on captive apes. .... I knew that it might take decades to achieve my goal of phasing out research on animals and to care humanely for the subjects, including my own. That's why I advocated a pragmatic approach: to reduce the pain and suffering of lab animals whenever possible and to find alternatives to animal subjects whenever feasible, which is quite often. By following this humane path, I hope that one day we finally empty all the cages in all the labs, including my own in Ellensburg. (p. 324-325)

chimpanzees are sometimes bored and dislike the fact that they cannot go beyond the enclosures they live in. These areas may be big, and the Fouts and their team may do very much to improve the chimpanzees' living conditions, still, they cannot go outside of the building. Their outdoor enclosure is outside, but it is an enclosure. From there they can only look at what is beyond the building, but never do they have the chance to go out there. In 1999 I once experienced a dramatic event when I was going home after a day of work at the CHCI. At that time Loulis and I were great playmates. He always asked for CHASE when he saw me and he got upset if I did not immediately play with him. He then spat at me and sometimes he went to the water spigot to fill up his mouth and then spat the water right into my face (sometimes even up to seven times), despite my signed excuses such as SORRY I WORK NOW or SORRY TIME CLEAN. I guess I had maybe become somewhat of a chimp toy for him, but I did not mind, because I interpreted his behaviour as being partially caused by the deprived conditions in which he had to live. One day then, I was going home and rode my bicycle past the outdoor enclosure of the CHCI. Loulis saw me and climbed up on the wire mesh, banging on the bars, his hair all pilo-erect. He started screaming and climbed all the way up to the top of the outdoor enclosure so he could still see me. As I rode along, his screams pierced my ears and I felt horrible at the situation that these chimpanzees had to be in that building the whole time, whereas we humans could go home and do whatever we pleased.

Several stereotypies have also been observed in the behaviour of the chimpanzees at the CHCI. These have not been studied systematically, but they seem to be linked to the impoverished conditions of living in captivity and the fact that they are not their own masters of their destiny. The Fouts now want to move the chimpanzees to a sanctuary, preferably one where the chimpanzees have a huge outdoor area to move in freely. Their dream was described by Fouts as follows: "an even better, semi-independent chimpanzee environment, which might be a protected forest habitat in Hawaii or some other tropical climate where they

could roam free, pick fruit, and socialize with friends" (1997, p. 382). I hope that a good place for them can be found and that there will be resources to take care of them there. Should you want to be of any help to the chimpanzees, I suggest that you contact the CHCI.[397]

The Fouts have told me that if it would be possible to turn back the clock, they would now consider it unethical to start projects with signing chimpanzees, because they eventually end up in lifelong captivity. This is also my own moral position on the subject. I am a deontological egalitarian (see Rivas, 1997) which means that I object to all experimentation and incarceration of animals (human and nonhuman). No matter how interesting the sign language projects can be for us humans, for the chimpanzee subjects it means losing control over their lives and spending their days behind bars. Indeed, the method of cross-fostering itself is a morally questionable practice, since it takes away the autonomy of the ape subjects and forces human practices and living conditions upon them, such as wearing clothes, being toilet trained and disciplined. I therefore do not wish to suggest that new projects with signing apes should be set up. Though in the previous chapters it was discussed that the current projects had their limitations and may not have expressed the full potential of symbolic communication in these chimpanzees, it would be morally wrong to find out more by starting new projects with captive apes.

We then come to the question of the moral implications of the study that I carried out. If the characterization of the chimpanzees' signing as non-linguistic is correct, then does this change their moral status? Before this study it was claimed that their signing behaviour was linguistic and that the chimpanzees approached the linguistic abilities of a child of about 2 years old, beyond Brown's Stage I. In the *Great Ape Project* or GAP, set up by the famous Australian moral philosopher Peter Singer (now at Princeton University) and the Italian

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[397] Donations can be made to the non-profit organization *Friends of Washoe*. One can also join this organization and regularly receive the *Friends of Washoe Newsletter*. For more information write to the Chimpanzee and Human Communication Institute. Central Washington University. 400 East Eighth Avenue. Ellensburg, WA 98926-7573. The CHCI's website can be found at www.cwu.edu/~cwuchci/.

ethicist Paola Cavalieri, the linguistic abilities of the great apes as evident from the language experiments were part of the moral argumentation to apply to all great apes the right to life, the protection of individual liberty, and the prohibition of torture. A major line of reasoning in this project, which was launched in 1993, is that a difference in moral treatment between humans and other great apes is unjustified because nonhuman great apes show many of the mental capacities of certain categories of humans, such as young children or humans with mental disabilities. Among these capacities is the ability to use language. The Fouts and the two other scientists working with signing apes, Penny Patterson of the gorillas Koko and Michael, and Lyn Miles of the orangutan Chantek, all have chapters in the book that sets out the arguments for the GAP. They provide details about the similarities in language use between the apes and young human children. The GAP reasons that if all humans are treated equally, including young children and humans with mental disabilities, then it is inconsistent that nonhuman apes who show the same capacities and abilities as these categories of humans are not included in the circle of equality.[398] However, if the results of this study are applicable to the projects with other apes as well, it could mean that the nonhuman great apes do not approach in any way the early language use of human children. There could thus be a difference in kind between humans and other apes that might still justify the use of nonhuman great apes in experimentation and other uses for human benefit. However, one should not forget the many nonlinguistic cognitive abilities that the nonhuman great apes share with young human children. Research has demonstrated similarities between these apes and

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[398] In an explanation of the GAP Cavalieri and Singer (1995) present the existence of language abilities in nonhuman great apes as morally relevant:

> We think that only prejudice can lead anyone to deny that language is being used in the Ameslan (or American sign language) interactions that occur between Francine Patterson and the gorillas Koko and Michael; between Lyn Miles and the orang-utan Chantek; and between Deborah and Roger Fouts and the community of chimpanzees associated with Washoe. .... Certainly the great apes' acquisition and use of Ameslan does point at such [important mental] capacities – in particular at the capacities for self-consciousness and for relating to others in sophisticated ways. Self-consciousness is most strikingly demonstrated by the fact that chimpanzees sometimes 'think aloud,' signing to themselves in appropriate ways when alone. (p. 374)

This and other evidence makes it "surely indisputable that the notion of person can meaningfully be applied to the other great apes" (p. 374).

human children in areas such as problem-solving, insight, mirror self recognition, memory, social and intentional behaviour, symbolic and numerical skills, object manipulation, tool use and tool making. Though the great apes may not be as advanced in language than children, they certainly are similar in their cognition. The Great Ape Project could thus still fight for an equality of all great apes because of all these abilities that are shared by all apes.

The question then becomes what moral relevance language has for the status of an animal. Is a linguistic ape more valuable than a nonlinguistic one? Do linguistic apes have more interests than nonlinguistic apes? Obviously the answer to these questions depends on the moral framework that one uses. In a utilitarian ethics, such as the preference utilitarianism of Peter Singer (1975/1990, 1979, 1987), the absence of linguistic abilities in nonhuman great apes might have moral consequences. In preference utilitarianism the mental abilities of beings determine the number and nature of preferences that can be at stake in solving a moral conflict between beings. Most important in this utilitarianism is the ability for self-awareness. Beings with self-awareness have an identity over time and an awareness of their future for which they have all kinds of plans and preferences. Should a situation occur in which one being has to be killed, as in a too small life-boat, killing a self-aware being would then lead to a greater loss of utility maximalisation than killing a non-self-aware being (see for a further description of moral systems in animal ethics my 1997 chapter). In what way might a linguistic animal have more preferences than a nonlinguistic one? At first glance it seems difficult to imagine particular preferences that are only related to language and are absent in nonlinguistic animals. With some imagination, however, one might say that a linguistic animal may have more specific knowledge of itself and the world and may have many more explicit preferences for the future, for example. In terms of utility maximalisation a linguistic animal might be of better use for society than a nonlinguistic one. A linguistic animal might for example, learn philosophy or become a scientist, and write many important things that could help the world at large. In a utilitarian framework, then, the possibility that nonhuman

great apes have not acquired language could have moral consequences in that their interests and preferences would be fewer than those of language using humans.

Another moral framework in animal ethics is deontological egalitarianism, as outlined especially by the American philosopher Tom Regan in his book *The Case for Animal Rights* (1983). His view is that there should be an egalitarian attitude towards all animals that are *subjects-of-a-life*.[399] Linguistic abilities do not explicitly make part of this criterion, so in Regan's rights view the nonhuman great apes would still be equal, even if they would not have language. My own moral framework is a modified version of Regan's. I consider the presence of phenomenal consciousness to be a morally sufficient condition for the recognition of an individual's inherent value and for an egalitarian treatment. As soon as a being has subjective experiences and can thus feel pleasure or pain, it should be treated on an equal level with all other experiencing beings. Differences in psychological complexity among beings should not sanction differences in treatment. Thus, in my own moral view, the possibility that nonhuman great apes do not have language has no moral consequences. Egalitarianism is still called for.

In conclusion then, a discussion should start about the moral relevance of language. Is a nonlinguistic Washoe less morally valuable than a language-using Washoe? Could a nonlinguistic Tatu be rightfully used in biomedical experimentation to save the lives of linguistic humans? I hope that our society will answer no to both questions and begin to appreciate the wonderful nature of all apes and animals.

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[399] Regan explains this criterion as follows:

> Individuals are subjects-of-a-life if they have beliefs and desires; perception, memory, and a sense of the future, including their own future; an emotional life together with feelings or pleasure and pain; preference- and welfare-interests; the ability to initiate action in pursuit of their desires and goals; a psychophysical identity over time; and an individual welfare in the sense that their experiential life fares well or ill for them, logically independently of their utility for others and logically independent of their being the object of anyone else's interests. (p.243)

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APPENDICES

A. The instructions for utterance boundaries.

B. Table of communicative intentions and their operational definitions.

C. Coding sheet to code the communicative intentions of sign utterances.

D. The signs used in the recent corpora and their frequencies.

APPENDIX A.

Instructions for determining the beginning and the end of chimpanzee signed utterances.

The beginning of an utterance starts differently for different signs. The beginning of an utterance starting with a Contact sign is the first time the hand configuration taps the body. For example, in the sign TATU, the first time the fist contacts the shoulder is the beginning of the sign. The beginning of an utterance starting with a Non-Contact sign is the first movement of the hand configuration in the place. For example, the sign COLD begins when the fists begin to shake in fron of the signer's chest. The beginning of an utterance starting with a Contact+Movement sign is the first movement after the hand configuration makes contact with the body. For example, the sign TOOTHBRUSH begins with the first horizontal movement of the index finger across the teeth.

The end of an utterance starts when the hand or hands drop from the place of the sign and the hand relaxes out of the configuration of the sign. For example, the sign COFFEE is made by stacking the fists in front of the body with the palms toward the body and then circling the top fist on the bottom fist. At the end of the sign, the hands separate, relax out of the fisted hand-shape and drop downward.

Another end of an utterance can take place when the configuration is held in place but there is no further movement. For example, in the sign COFFEE, an individual may end an utterance by stopping the circling movement of the top fist, but leaving the top fist stacked on the bottom fist.

Note that hand changes can still be part of the same utterance, as long as there is fluidity of movement, or fluid motion, of the hands and no full stop is made.

APPENDIX B.

Table of communicative intentions and their operational definitions.

Used by the coders. For each intention the following was specified in this table: the definition of the intention, examples of signs in chimpanzee utterances that could be part of that intention, accompanying chimpanzee behaviours for that intention, contextual aspects that belong to that intention, specific human behaviours that accompany the intention, examples from child utterances with that intention from the literature, examples of chimpanzee utterances with that intention, and lastly some important notes.

Communicative intention	Definition	Signs of chimp utterance
NAM - Naming/Labeling	The chimpanzee labels, identifies or names an observable object, event, person, action or situation.	- The utterance does **not** contain request markers like GIMME, HURRY, MORE and PLEASE.
PRO - Properties	The chimpanzee labels perceivable attributes of objects or events, such as color, shape or movement.	- Signs that may be part of the utterance: color signs (BLACK, RED), materials (GLASS), qualities (HOT, SWEET). - The utterance does **not** contain request markers like GIMME, HURRY, MORE and PLEASE.
POS - Possessions	The chimpanzee indicates who owns or temporarily possesses an object.	- Signs that may be part of the utterance: possessives (MINE, YOURS). - The utterance does **not** contain request markers like GIMME, HURRY, MORE and PLEASE.
LOC - Locations	The chimpanzee indicates the location or direction of an object, event, etc.	- Signs that may be part of the utterance: locatives (IN, OUT, UP, THERE). - The utterance does **not** contain request markers like GIMME, HURRY, MORE and PLEASE.
RQO - Request for Object	The chimpanzee solicits the human companion to provide an object which is usually out of reach for the chimpanzee.	- Signs that may be part of the utterance: request markers, such as GIMME, HURRY, MORE and PLEASE. - Signs within the utterance may be repeated to indicate emphasis.
RQA - Request for Action	The chimpanzee solicits the human companion to act upon some object or to carry out some other action.	- Signs that may be part of the utterance: request markers, such as GIMME, HURRY, MORE and PLEASE. - Signs within the utterance may be repeated to indicate emphasis
RQI - Request for Information	The chimpanzee solicits the human companion to provide information about an object, action or location.	- The signs may be inflected into the question form.
CAL - Calling/ Request for attention	The chimpanzee makes contact with the human by soliciting attention.	- Signs that may be part of the utterance: the name sign of the human or other signs that draw the human's attention.

Chimpanzee behaviour	Context	Human behaviour
- shows entity - picks up entity - points to entity - looks at entity - approaches entity - **no** prolonged looking at human	Human and chimpanzee are looking at pictures (in a picturebook, magazine, etc.) or at an array of objects.	- has named pictures or objects before - asks WHAT THAT? while pointing to picture or object - responds by signing YES or NO
- shows entity - picks up entity - points to entity - looks at entity - approaches entity - **no** prolonged looking at human	Human and chimpanzee are looking at pictures (in a picturebook, magazine, etc.) or at an array of objects.	- has named pictures or objects before - asks WHAT THAT? while pointing to picture or object - responds by signing YES or NO
- shows entity - picks up entity - points to entity - looks at entity - approaches entity - no prolonged looking at human	Human and chimpanzee may be looking at pictures (in a picturebook, magazine, etc.) or at an array of objects.	- has named pictures or objects before - asks WHOSE THAT? while pointing to picture or object - responds by signing YES or NO
- shows entity - picks up entity - points to entity - looks at entity - approaches entity - no prolonged looking at human	Human and chimpanzee are looking at pictures (in a picturebook, magazine, etc.) or at an array of objects.	- has named pictures or objects before - asks WHERE? - points to picture or object - responds by signing YES or NO
- looks at entity - touches entity - points to entity - reaches towards entity - leans towards entity - stretches hand towards entity - awaits response/prolonged looking at human - repeats utterance when the human just plays with an object (so the chimp wants to physically obtain an object)	Objects are present.	- refuses request by signing (combinations with) CAN'T, SORRY, or LATER - gives the object the chimpanzee asked for
- looks at entity - points to entity - awaits response/prolonged looking at human - has playface - does **not** repeat request when the human reacts with playful action	- Playful interaction with human. - The entity that the chimpanzee looks at or points to, has ceased moving or has the potential to be moved.	- refuses request by signing (combinations with) CAN'T, SORRY, or LATER - does not react by giving an object or refusing it - engages in the action the chimpanzee has requested
- awaits response/prolonged looking at human (chimp requests additional input about a referent)		- gives the requested information or answers the chimpanzee's question - may answer I DON'T KNOW
- awaits response/prolonged looking at human		- may be some distance away or not attending to the chimpanzee before the chimpanzee's utterance - orients towards or attends to chimpanzee after the chimpanzee's utterance

Child examples	Chimpanzee examples	Important notes
- 'Ball.' - 'Cow.' - 'That's a car.' - Child touches a doll's foot and says 'Foot.'	- HAT, after human asked WHAT LOOK? - CARROT, after human asked WHAT FOOD THAT? - SODAPOP, after human asked WHAT THAT?	
- 'Big ball.' - 'That's a red crayon.'		
- 'That's mine.' - 'That's John's.'		
- 'The zoo is far away.'		
- 'Give me that.' - 'Want some coke.' - 'More.' - 'Cake.'	- FOOD ME GIMMIE GIMMIE DRINK TOOTHBRUSH. - GIMME DRINK PLEASE. - GUM HURRY.	- The chimpanzee can also direct the human to furnish an entity not existent in the immediate environment, in producing a sign or sign combination.
- 'Do that again.' - Child says 'Open' while giving jar to adult. - 'Put the toy down!'	- CHASE.	
- 'Where's John?' - 'Where go?' - 'What's that?'		
- 'Hey, John!' - 'Mommy.' - 'Look!'		

Communicative intention	Definition	Signs of chimp utterance
PRT - Protesting	The chimpanzee objects to or expresses disapproval of the human's action or utterance.	- Signs that may be part of the utterance: NO.
APO - Apology /Appeasement	The chimpanzee apologizes for misbehaviour or appeases human.	- The chimpanzee produces a sign which may appease the human or is interpreted by human as apology for misbehaviour. The signs SORRY or GOOD may be part of the chimpanzee's utterance.
INT - Internal reports	The chimpanzee expresses an internal state (emotions, sensations, etc.), capacities or intents to perform an act.	
ATT - Attributions	The chimpanzee expresses beliefs about another's internal state, capacity, intent, etc.	
EVA - Evaluations	The chimpanzee expresses impressions, attitudes or judgments about objects, events or situations.	
EXP - Explanations	The chimpanzee reports reasons, causes, and motives for acts, or predicts future states of affairs.	
MAR - Markings	The chimpanzee marks a variety of events.	- announces an event (TIME EAT) - use a marker sign in connection with routine activities (the use of markers ENOUGH and FINISH) - use the sign GOODBYE at departures
ANS - Answering	The chimpanzee responds to a question or request for information from the human with the semantically appropriate data. **Note: This category is NOT to be part of double-codes, only code it alone**	- Some of the signs of the human's preceding question may be repeated or imitated.
UNC - Unclear	The intention is unclear and the contextual information is not enough to classify it into one of the categories of intentions.	

Chimpanzee behaviour	Context	Human behaviour
- shakes head from side to side (as in the sign NO) - tries to prevent the human action		- iniates an activity that the chimpanzee rejects, dislikes or declines to perform - may stop the activity the chimpanzee protests against
- has misbehaved or done something wrong according to human		- may be punishing or scolding the chimpanzee
- utterance follows a question from the human companion (who used the appropriate inflectional technique for questions) - addresses human		- has asked the chimpanzee a question, by using the appropriate inflectional technique for signing questions - is awaiting the chimpanzee's response, by looking at the chimpanzee, and having its head oriented towards chimpanzee

Child examples	Chimpanzee examples	Important notes
- 'No, don't touch that.' - 'Stop!' - 'No!'		
- 'My leg hurts.' - 'I like it.' - 'I know.'		- This category is not operationally defined and has to be determined by the semantic information in the chimpanzee's utterance.
- 'He doesn't know the answer.' - 'He wants to.' - 'He can't do it.'		- This category is not operationally defined and has to be determined by the semantic information in the chimpanzee's utterance.
- 'It looks like a snowman.' - 'That's good.'		- This category is not operationally defined and has to be determined by the semantic information in the chimpanzee's utterance.
- 'He did it cause he's bad.' - 'I did it because it's fun.'		- This category is not operationally defined and has to be determined by the semantic information in the chimpanzee's utterance.
- 'Thank you.'		- Only code utterances with the TIME marker if they can **not** be interpreted as requests. So if the chimp, human behaviour and other contextual aspects correspond to a request category, code the utterance as request.
- 'Yes.' - 'No.'		- First try to classify the utterance into the other categories of intentions. Only when the utterance does not fit one of these, and it is still a transmission of information, can you code this category, so do **not** let it be part of a double-code.
		- The utterance and contextual indicators are too unspecified to assign it to any of the above categories.

APPENDIX C.

Coding sheet to code the communicative intentions of sign utterances.

Session nr Chimpanzee Human Utterance nr	Example of NAMING	Example of REQUEST for OBJECT	Example of REQUEST for ACTION
Sign(s)	HAT	GUM HURRY	CHASE
inflection		repetition	repetition
Chimpanzee behaviours			
shows entity	y		
picks up entity	y		
points to entity	y	y	y
looks at entity	y	y	y
touches entity		y	
reaches towards entity/human		y	
leans towards entity		y	
stretch hand towards ent		y	
approach entity	y		
awaits response/prolonged -			
looking at human		y	y
has playface			y
shakes head side/side			
tries to prevent h action			
repeats utt as h com play		y	
Other (agonistic/threat, atten-			
tion, play, greeting, voc., etc.)			
context: picturebook	y		
context: objects	y	y	
context: play			y
human: named before	y		
h: signed WHAT THAT? before	y		
h: points to picture	y		
h: points to object	y		
h: responds YES/NO	y		
h: resp CAN'T, SORRY, LATER		y	y
h: gives object		y	
h: engages in action			y
h: stops action			
h: orients towards/attends to -			
chimpanzee (not before)			
h: plays w/ object			
h: considers c to misbehave			
h: has punished/scolded c			
Human previous utterance	WHAT LOOK?	WHAT WANT?	YOU PLAY?
Communicative intention	NAM	RQO	RQA

APPENDIX D.

The signs used in the recent corpora and their frequencies.

Frequency presented for each sign as follows:

Washoe+Moja+Tatu+Dar+Loulis=All chimpanzees

COME/GIMME: 339+42+35+15+28 = 459 (9.6%)

THAT: 37+105+100+58+61 = 361 (7.6%)

DRINK: 116+92+124+14+0 = 346

FLOWER: 149+62+23+28+0 = 262

YOU: 0+108+112+16+1 = 237

FOOD/EAT: 42+52+79+27+0 = 200

SMELL: 0+87+102+0+0 = 189

GUM: 138+5+4+40+0 = 187

BRUSH: 3+125+40+0+0 = 168

TOOTHBRUSH: 56+46+14+46+0 = 162

HURRY: 87+39+27+2+4 = 159

THERE: 4+77+37+24+1 = 143

BLACK: 0+0+137+0+0 = 137

COFFEE: 19+3+80+14+0 = 116

CLOTHES: 0+103+0+0+0 = 103

TATU: 0+0+88+0+0 = 88

DAR: 0+0+0+86+0 = 86

RED: 3+71+6+0+0 = 80

CHEESE: 0+0+65+2+0 = 67

SHOE: 10+27+0+25+0 = 62

GOOD: 3+27+7+23+0 = 60

NUT: 8+28+13+8+0 = 57

HOT: 54+0+0+0+0 = 54

CHASE: 0+0+3+32+14 = 49

PEEKABOO/MASK: 0+40+7+2+0 = 49

MOJA: 0+47+0+0+0 = 47

WATER: 1+1+40+0+0 = 42

HUG: 32+5+1+0+0 = 38

TIME: 1+0+36+0+0 = 37

CRACKER: 3+10+5+16+0 = 34

MEAT: 1+0+33+0+0 = 34

BIRD: 19+10+0+2+0 = 31

ICE/COLD: 0+0+32+0+0 = 32

IN: 5+1+6+19+0 = 31

BOOK: 26+4+0+0+0 = 30

GRASS: 2+2+1+24+0 = 29

WASHOE: 26+0+0+0+0 = 26

PLEASE: 13+5+5+1+0 = 24

SWEET: 0+16+2+5+0 = 23

MORE: 4+3+0+15+0 = 22

BANANA: 1+5+7+9+0 = 22

OUT: 6+0+3+13+0 = 22

ME: 17+1+0+4+0 = 22

PERSON: 12+7+2+0+0 = 21

FLOWER/SMELL: 0+17+1+1+0 = 19

FRUIT: 17+0+0+0+0 = 17

DIRTY: 10+0+0+4+0 = 14

OIL: 0+1+13+0+0 = 14

CORN: 2+10+1+0+0 = 13

APPLE: 0+8+5+0+0 = 13

GO: 5+2+5+0+0 = 12

LIPSTICK: 0+0+12+0+0 = 12

BOY: 0+0+0+12+0 = 12

SODAPOP: 0+8+2+1+0 = 11

CARROT: 0+0+11+0+0 = 11

PLANT: 0+0+11+0+0 = 11

TEA: 0+0+11+0+0 = 11

GROOM: 0+8+1+1+0 = 10

LIGHT: 0+0+0+10+0 = 10

DOG: 2+2+0+5+0 = 9

SEE/LOOK/GLASSES: 0+9+0+0+0 = 9

ONION: 1+6+1+0+0 = 8

HAIR: 0+8+0+0+0 = 8

GO-YOU: 0+0+8+0+0 = 8

TICKLE: 0+1+0+6+0 = 7

CEREAL: 0+0+7+0+0 = 7

BLANKET: 0+5+1+0+0 = 6

ICECREAM: 0+1+5+0+0 = 6

HAT: 0+4+1+0+0 = 5

GIMME-HURRY: 4+0+0+0+0 = 4

KEY: 4+0+0+0+0 = 4

NO: 0+4+0+0+0 = 4

MILK: 0+0+4+0+0 = 4

PASTE: 0+0+0+4+0 = 4

COOKIE: 0+2+1+0+0 = 3

BERRY: 1+2+0+0+0 = 3

RICE: 0+1+2+0+0 = 3

HEIDI: 0+0+0+3+0 = 3

CAT: 2+1+0+0+0 = 3

SANDWICH: 0+0+3+0+0 = 3

PAINT: 0+0+3+0+0 = 3

COMB: 1+1+0+0+0 = 2

HEAR/LISTEN: 0+1+0+1+0 = 2

WRISTWATCH: 0+2+0+0+0 = 2

CRY: 0+2+0+0+0 = 2

PEEKABOO/SMELL: 0+2+0+0+0 = 2

POPCORN: 0+0+2+0+0 = 2

ORANGE: 0+0+2+0+0 = 2

HURRY-GO: 1+0+1+0+0 = 2

YOU-HURRY: 0+0+2+0+0 = 2

HURRY-YOU: 0+0+2+0+0 = 2

COVER: 1+0+0+0+0 = 1

THAT-GIMME: 1+0+0+0+0 = 1

HURRY-THERE: 1+0+0+0+0 = 1

HURRY-COME: 1+0+0+0+0 = 1

GIMME/COME: 1+0+0+0+0 = 1

GIMME-DRINK: 1+0+0+0+0 = 1

COW: 1+0+0+0+0 = 1

GO-THERE: 0+1+0+0+0 = 1

GIMME-THERE: 0+1+0+0+0 = 1

POTATO: 0+1+0+0+0 = 1

HURT: 0+0+1+0+0 = 1

ROGER: 0+0+1+0+0 = 1

HURRY-GIMME: 0+0+1+0+0 = 1

YOU-GIMME: 0+0+1+0+0 = 1

GIMME-THAT: 0+0+0+1+0 = 1

SWALLOW: 0+0+0+1+0 = 1

Total times: 1,295+1,363+1,348+661+109 = 4,776

88 different signs

Total utterances: 612+731+899+507+90 = 2,839

FLOWER and SMELL were considered separate signs here, THAT/THERE/YOU same, COME and GIMME also the same sign, and finally PEEKABOO and MASK the same sign. The compound signs with request markers (such as GIMME-HURRY) were not considered to be new signs.

THAT/THERE/YOU combined: 361+143+237 = 741 (15.5%)

SUMMARY

This dissertation describes the research on the use of human taught signs by chimpanzees and includes the description of a study that was carried out to analyze the recent use of these signs by five signing chimpanzees: Washoe, Moja, Tatu, Dar, and Loulis.

In *Chapter 1: Sign language research with chimpanzees* a comprehensive introduction is given of the various projects with signing chimpanzees. Through the ages scientists and philosophers have wondered whether nonhuman animals, and in particular nonhuman great apes, the closest animal relatives of humans, were able to learn a human language, and could express their thoughts and feelings by means of this acquired language. In the 20th century several attempts were made to teach chimpanzees a spoken language. These were unsuccessful, with the biggest achievement coming from the chimpanzee Viki (studied by Keith and Catherine Hayes), who could produce with great difficulty four words (*mama, papa, cup* and *up*). This lack of success led to the idea that nonhuman great apes were unable to learn a human language. (Neuro)anatomical differences between humans and other apes have been suggested as the explanation for the failure of these spoken language experiments.

In the 1960s, however, a married couple of (behaviourist) psychologists, Allen and Beatrice Gardner, from the University of Nevada at Reno, struck at the genious idea of using a visual-gestural rather than an auditory-vocal language. They set out to teach chimpanzees hand signs instead of spoken words. The manual dexterity of chimpanzees, together with their natural use of communicative gestures, suggested that it was possible for them to learn signs. In June 1966 the Gardners obtained an infant female chimpanzee, aged between 8 and

14 months, named her Washoe, and began teaching her signs. This was the start of Project Washoe, which was to last for four years and three months (until October 1970). Washoe was kept in a housetrailer in the Gardners' backyard. She was "cross-fostered" by the Gardners and their team, that is, she was raised as closely as possible to the way a child grows up in a human household. Washoe was dressed in clothes and was submitted to discipline and cleaning acitivities, such as brushing her teeth. She learned to eat with forks and spoons while sitting in a high chair with a bib around her neck. She was given objects children get when they are young, such as toys, picturebooks, and magazines. The humans in this project also played many different games with Washoe, such as chase and hide-and-seek. She was also taken on outings, such as trips to the woods. This cross-fostering was done in order to see in what way environmental conditions influence behaviour. The Gardners wanted to find out to what extent a chimpanzee could acquire human behaviour, of which language was considered one aspect. As part of this upbringing Washoe was taught signs, the majority of which were based on signs from American Sign Language (ASL). The humans in the project signed about everything that happened. To teach Washoe the signs, a mixture of methods was used, varying from giving rewards to simple modeling (in which humans show how the sign is produced). Moulding proved to be the most effective method. In this procedure, the humans took the hands of the chimpanzee and moulded or formed them into the correct configuration, put them through the correct movement, and directed the hands to the correct place of the sign that they were teaching.

Project Washoe was very successful. At the end of the project Washoe had acquired 132 signs. This success inspired projects in which signs were taught to gorillas (Koko and Michael, studied by Francine Patterson), and an orangutan (Chantek, studied by Lyn Miles). It was also of great influence for the work of Duane Rumbaugh and Sue Savage-Rumbaughs with common chimpanzees (Sherman and Austin), as well as their later work with pygmy

chimpanzees or bonobos (Kanzi and others). For the whole field of ape language Project Washoe has been of utmost importance.

A second project was subsequently carried out by the Gardners, this time using four newly born chimpanzees: Moja, Pili, Tatu, and Dar. Similar to Washoe, these four chimpanzees were also cross-fostered and taught signs. They too were successful in acquiring the signs and were even seen to use them amongst each other. In the meantime, Roger Fouts, a graduate student from the Gardners who had been part of Project Washoe from 1967, together with his wife Deborah, carried on research with Washoe, taking her in 1970 to the Institute for Primate Studies of the University of Oklahoma in Norman. Fouts also taught several other chimpanzees at this institute some signs and analyzed the use of signs when the chimpanzees communicated with each other. In 1979 the Fouts set up Project Loulis. Loulis was a 10-month-old male chimpanzee who was adopted by Washoe. From his arrival the humans only used seven signs and spoken English in Loulis' presence. They kept this up for more than five years, at the end of which Loulis had acquired a vocabulary of 51 signs. Most of these signs had been acquired by observational learning, but there were also a few observations in which Washoe was actively teaching Loulis. The Fouts interpreted the results of their project to mean that cultural transmission of a human language by chimpanzees had taken place.

In 1980 the Fouts and their chimpanzees moved to Central Washington University in Ellensburg, Washington. In 1993 they set up the Chimpanzee and Human Communication Institute, which contains improved living conditions for the chimpanzees. They continued studying the signing behaviour of Washoe and Loulis, as well as Moja, Tatu, and Dar (who had been sent to the Fouts when the Gardners' second project ended).

A further project in which signs were taught to a chimpanzee was set up by Herbert Terrace, a psychologist from Columbia University in New York. He began Project Nim, with the chimpanzee Nim Chimpsky (named after the famous linguist Noam Chomsky). It took

place from 1973 to 1977. Terrace started off with the same hopes and enthusiasm of the time. His major goal was to collect a large corpus of sign utterances to analyze whether a chimpanzee was capable of producing actual sentences, that is, utterances showing a structure governed by grammatical rules. Only then would Terrace consider the signing to be demonstrative of linguistic competence. Dogs and other animals are able to learn individual arbitrary signs or words in order to obtain rewards, but that ability should not be confused with language. Project Nim employed methods comparable to those of the Gardners. Nim acquired 125 signs. At the end of the project Terrace made extensive discourse analyses of videotaped interactions between Nim and the humans. These and other results led to quite different conclusions on chimpanzee sign use than those of the Gardners and Fouts. This discongruence in opinion between the two teams (the Gardners/Fouts and Terrace and colleagues) resulted in a debate on the signing of chimpanzees and other apes that has become known as the ape language controversy.

After this introduction of the two teams of chimpanzee sign researchers, *Chapter 2: The results of the projects with signing chimpanzees* consists of an extensive presentation of the results of their research. These results are presented according to the major aspects of the signing behaviour. Section *2.1. Signs*, focuses on individual signs. The acquisition criteria for the signs are presented. Each chimpanzee sign received a gloss that approximated the best English word to describe the sign's use. For example, a sign that was used to refer to an apple, was glossed APPLE (by convention the gloss of signs are printed in capitals). Several classification methods were used to determine the semantic categories of the chimpanzee signs. One of these was a a double-blind procedure used by the Gardners to test object signs. Both teams of researchers agreed that the chimpanzees had acquired signs in the following semantic categories: objects, actions, names, person terms, locations, colours, qualities, request markers, and traits. According to the Gardners, their chimpanzees furthermore acquired signs in the categories of generic names, possessives, materials, quantitatives,

comparatives, and certain question signs. They also claimed a striking similarity in content between the chimpanzees' vocabularies and the early vocabularies of human children. The published information on the frequency with which the individual signs were used is next presented in this section. The Terrace team found that Nim's use of his vocabulary was skewed: several signs occurred very frequently (NIM, ME, YOU, EAT, DRINK, MORE, and GIVE) while other signs were made infrequently. The frequent signs were therefore called wild card signs, which are signs that are appropriate to almost every context. The Gardners published less extensively on the frequency in which the chimpanzees used their signs. The Fouts published more details on frequency in their analysis of Project Loulis and the two studies on private signing. All signing chimpanzees used several signs very frequently.

Section *2.2. Combinations* deals with the combinations of signs that the chimpanzees produced. Soon after acquiring their first signs, the chimpanzees started to combine them into multiple-sign utterances. Terrace calculated the Mean Length of Utterances of Nim and found that this did not increase in time, staying between 1.1 and 1.6 in the last 1.5 years of the project. The two-sign combinations that the chimpanzees produced were analyzed for the presence of semantic relations. In a semantic relation each sign has a particular semantic role and the two signs express a meaningful relation, such as agent+action (TATU DRINK), object+action (BALL CATCH), and attribution (BLACK HAT). According to the Gardners and Fouts semantic relations were present in the chimpanzee combinations, sometimes up to 78 or 90%. Terrace and his colleagues at first also appeared to have found semantic relations in Nim's 2-sign combinations. However, they turned skeptical about this conclusion because Nim only used a small variety of signs for the semantic roles. For example, 90% of his location combinations only contained the locative sign POINT. More importantly, when the Terrace team later analyzed videotaped combinations they found that imitation played an important role in the chimpanzee's signing behaviour. By imitating humans, Nim could produce utterances that had a "semantic relational look," but without there actually being a

structure. Terrace and colleagues concluded that there was no evidence for semantic relations. The Gardners and Fouts further claimed that the chimpanzees creatively produced new combinations to describe objects for which they had not yet been taught a sign. The most famous example was Washoe describing a swan as WATER BIRD. Terrace and his team, however, interpreted these special combinations as strings of signs that were all individually relevant to the situation, but unrelated to each other. They also suggested that when the chimpanzees randomly combine signs, some of these eventually appear like they are creative meaningful combinations. The next subject that was analyzed with regards to the chimpanzees' combinations was the possible presence of grammatical structure in the form of order preferences. The Gardners found several order preferences, but at first they were cautious to interpret these as evidence for syntactical rules. The preferences might have come about by semantic habits or imitation of the humans. From 1978 onward, though, the Gardners and Fouts interpreted order preferences as grammatical devices. Terrace also found several order regularities in Nim's combinations, but because these were derived from unfilmed utterances, the possible role of imitation made it unwarranted to interpret these as syntactical in nature. With regards to multiple-sign combinations of three or more signs, the Gardners and Fouts concluded that as the utterances increased in length, so did their informational content. Terrace, however, found that Nim's longer combinations did not show such an increase in information. Instead, there was a large overlap in content among combinations of different length. Nim's multiple-sign combinations showed frequent repetition (NIM EAT NIM) and redundancy (adding NIM to a sequence already containing ME). He also stringed object and action signs with the wild card signs mentioned above. Nim's longest combination, of 16 signs, was: GIVE ORANGE ME GIVE EAT ORANGE ME EAT ORANGE GIVE ME EAT ORANGE GIVE ME YOU. This stringing of unrelated signs suggested a pragmatic strategy on the part of the signing chimpanzees that consisted of producing more signs in order to improve the chances of getting something from the humans.

In section *2.3. Discourse and conversational skills*, the results concerning discourse phenomena and conversational skills are presented. Terrace's discourse analysis of videotaped human-chimpanzee interactions showed several unexpected phenomena. Only 13% of Nim's utterances were spontaneous, that is, not preceded by a human utterance. This led Terrace to characterize ape signing as nonspontaneous in nature. The Gardners and Fouts defined spontaneity only in relation to imitation, so did not publish similar data. In terms of initiation of sign interactions, the Gardners and Fouts reported high percentages of spontaneous chimpanzee initiation, while Terrace found that most of the signing was initiated by the human. Another result of Terrace's video-analyses was that Nim had a high rate of interruption of the human, indicating that he had not grasped the conversational rules of turn-taking. The Gardners and Fouts disagreed and interpreted interruption as normal turn-taking behaviour in sign language. The most important discovery of Terrace's video-analyses was that Nim's utterances were often full or partial imitations of the human's signs. Nim showed imitation in 39 to 54% of his utterances, which was much higher than children show. The Gardners and Fouts acknowledged the presence of some imitation, but interpreted this as a pragmatic device to indicate assent or emphasis. However, they did not make analyses comparable to those of Terrace, nor did they initially use filmed material to determine the role of imitation in their chimpanzees' signing. Instead, they criticized the methods, procedures, and design of Project Nim as accounting for the differences in results between the projects.

Section *2.4. Communicative intentions* is dedicated to the chimpanzees' motivation for using signs. Intentional communicative behaviour has been found in nonhuman great apes. Communicative intentions are the reasons for which the chimpanzees produce sign utterances. Terrace and his colleagues concluded that the signing of apes was *acquisitive* in nature: they made signs in order to obtain desired objects, activities and other things from the humans. Though Terrace mentions that Nim also named objects and pictures, he considered

this form of signing to be different from what human children do. Children have an intrinsic motivation to use language and utter words to draw attention to something just for the sake of doing so. Only Nim's signing when privately looking at pictures might not be request-oriented. Terrace and colleagues, however, did point out that the findings in the various projects might not reflect the full potential for language of nonhuman great apes. The Gardners said that the chimpanzees' sign use went beyond requesting and that the chimpanzees had an intrinsic motivation to communicate information: the chimpanzees named, commented on events, and asked questions. The Fouts argued that the signing of chimpanzees amongst themselves was not request-related but socially oriented. They also claimed that the chimpanzees will even express their internal states such as emotions and feelings (by using signs such as HURT, CRY and FUNNY) and have also been seen to insult others (by calling them things like DIRTY). The private signing of the chimpanzees (when they are by themselves or not in communication with someone else) was also considered to be evidence of signing that does not involve requests.

Chapter 2 concludes with section *2.5. Language* in which the opinion of the various researchers and other scholars is given on the question whether the signing of the chimpanzees is comparable to the early language of human children and may therefore be called language. The Gardners and Fouts claimed that there were many similarities with human children acquiring language. The chimpanzees had not just acquired signs, but *sign language*. Not calling it language would be discontinuous, undarwinian thinking, amounting to "scientific apartheid." Terrace and his team drew attention to the large differences that they found between signing apes and language-developing children. The signing apes had merely learned an artificial method by which to communicate demands in a nonconversational manner. It would be altogether unjustified to call the apes' behaviour language.

It is clear, then, that there are big differences of opinion between the two teams of scientists that studied signing chimpanzees. These points of controversy are difficult to

decide upon, because some of the data and conclusions suffer from serious problems in the methods that were used, and in the way in which some results were interpreted. The major problems that exist are presented in *Chapter 3: Problems of method and interpretation.* In the first section of this chapter, *3.1. Anecdotes and individual observations*, the problems of using individual observations and anecdotes as evidence are discussed. The reliability of such records is insufficient. Errors in perception and errors of memory can easily occur when reporting individual observations of chimpanzee sign use. Also, these records do not contain reliable information on the human input on the chimpanzee's signing. There is therefore no way to check for imitation of the human by the chimpanzee. In the absence of a permanent record, such as film or videotape, there is no possibility to check the accuracy of the observations. Many data in the projects were based on individual observations, thus making them an unreliable source of information. The Terrace team, however, learned an important lesson when they started analyzing videotaped instances of chimpanzee signing. These showed other phenomena than had been expected (see above). They therefore dismissed all earlier claims that had not been based on permanent records such as film or videotape. Since the early 1980s the Fouts began using videotaped material as a standard of their data collection procedures, but kept presenting individually observed sign instances as reliable accounts of their chimpanzees' signing behaviour.

Section *3.2. Corpora* discusses the importance of analyzing and publishing sufficiently large corpora of sign use by the chimpanzees. Only by systematic collection and analysis of large corpora of the use of the particular signs by the chimpanzees, can judgments be made about the signs' nature. This is so both for the purported meanings of individual signs, as well as for communications expressed within combinations of signs. For example, the WATER BIRD combination looses much of its significance if Washoe also produces many less apparently meaningful combinations such as WATER BANANA and COOKIE BIRD. The Gardners and Fouts, however, have made use of incidental occurrences of sign

use in their characterizations of the chimpanzees' sign use, omitting a systematic analysis of large corpora of the signs used in these incidental examples. Sometimes, though, larger numbers of sign use were collected, especially in the Wh-question tests. Some of these corpora were published, but this generally consisted of presenting percentages and numbers with regards to specific research questions, while more detailed important information, such as the exact signs that were used and their frequencies, was not published (though the private signing studies are a good exception). Mark Seidenberg (of the Terrace team) accused the Gardners of employing what he called the *consistency criterion*: selectively citing several examples of sign use that appear to be consistent with a linguistic interpretation without further publication of the complete corpora. The Terrace team collected several systematic corpora of thousands of Nim's utterances, which enabled clear presentations of detailed information on the individual signs and combinations (and their frequencies) that Nim produced.

Section *3.3. Drill and human prompting* concerns the role of drill and human prompting in the chimpanzee sign projects. Drill sessions, the use of rewards, social reinforcers such as praise, threats if the chimpanzees did not cooperate, and other forms of human enforcement of chimpanzee sign production took place to some extent in all the projects. The chimpanzee subjects in the projects were forced to sign as a matter of principle, because they were under the researchers' custody and were not asked for their consent to participate. The humans also asked the chimpanzees many questions throughout each day. This may have led to routine question-answer patterns without true understanding of the questions, or without an intrinsic motivation to respond. All forms of drill and human prompting may in general have depressed the chimpanzees' intrinsic motivation to use signs and stimulated extrinsic motivations: signing in order to obtain desired objects and actions, or to please the humans, fulfill their demand to sign, and avoid hassle. This situation makes it

difficult to determine what the motivationally spontaneous use of signs by the chimpanzees is like.

In the last section of chapter 3, *3.4. Remaining problems*, further serious problems in the projects with signing chimpanzees are presented. In the Gardners' projects some signs may have become reliable by memorization alone, because teaching and testing often took place on the same day. Another problem is that several signs were very similar to natural communicative gestures of chimpanzees (COME/GIMME, HURRY, and OPEN), causing a possible inflation of the chimpanzees' use of actual signs. A later method of the Gardners to assess semantic relations without having to interpret the utterances, though introduced in order to be objective, may have erroneously categorized utterances as instances of semantic relations. For example GUM CHASE would have automatically been assigned to the object+action relation. However, this may not be an internally related utterance but an expression of a request by the chimpanzee to both have gum and be chased. Several discourse studies also suffer from methodological problems. For example, the fact that spontaneous utterances were found to occur less often in drill sessions was an artefact of the design of these studies, because there were hardly any possibilities for the chimpanzees to sign without a preceding human utterance in drill sessions. Still other problems regard the interpretation of certain sign utterances as expressing specific communicative intentions. Utterances with question modulations were interpreted as instances of asking questions. However, there was no distinction between asking for goods and services and actual requests for information. The interpretation of chimpanzee-to-chimpanzee signing as not request-oriented, ignored the fact that most of the times this signing appeared to function as action requests, such as for play. The interpretation of DIRTY as an insult becomes less plausible considering that it is a noisy sign that can function as an attention-getter.

The published data thus leave ample room for disagreement and confusion, and may have led to an inaccurate view of what actually occurs when the chimpanzees use signs. In

order to clarify these issues and to obtain a new large corpus of reliable data, a new study was set up by the author, with the help of the Fouts and their students. This study is presented in *Chapter 4: A study of the recent sign use of five signing chimpanzees.* In section *4.1. Introduction*, the study is introduced. It was a descriptive behavioural study that had two central methods: the consistent use of video material and the systematic analysis of large corpora. The study had the following three research questions:

- What signs are used by the chimpanzees and what possible semantic categories do these belong to?
- What combinations of signs do the chimpanzees make and is there any semantic or grammatical structure in these sequences? Are semantic relations present and do order preferences exist?
- What are the communicative intentions of the chimpanzees when they use signs?

Section *4.2. Method* describes in detail the methodology of this study. Four large corpora of recent sign use, dating from 1992 to 1999, were analyzed. The corpora contained relatively unstructured human-chimpanzee interactions that included all five chimpanzees at the Chimpanzee and Human Communication Institute (CHCI) in Ellensburg: Washoe, Moja, Tatu, Dar, and Loulis. The interactions were filmed in various places within the chimpanzees' living areas in the institute. The four corpora consisted of 22 hours of videotape. The signs of both humans and chimpanzees in these videotaped interactions were transcribed, the boundaries of the chimpanzee utterances were determined and each chimpanzee utterance was coded for communicative intention.

Section *4.3. Results* present the results of this study. In the four corpora the chimpanzees made a total of 3,448 utterances. Excluding those utterances that only consisted of imitated signs, the total was 2,839. The predominant communicative intention of the chimpanzees was to make requests: 86% of all utterances were requests for objects and actions (with a range for the corpora of 63-96%). Requests for objects were made three times

as often as requests for actions. The chimpanzees used the following signs in requests for objects: signs for edibles such as FLOWER (for edible plants), GUM, COFFEE, CHEESE, NUT, DRINK, and FOOD/EAT; and signs for inanimate objects such as TOOTHBRUSH, SHOE, and CLOTHES. In requests for actions the chimpanzees used action signs such as BRUSH, SMELL (used especially to ask the humans to blow their breath to the chimpanzee), CHASE, and PEEKABOO. The communicative intention of Naming or labeling of objects and pictures also occurred, but only in 2% of all utterances, and all except two of these followed a human question or prompt to name an object or picture. The only other communicative intention found was Answering (4%), consisting of simple responses to human questions. In many of these replies the chimpanzees used their own name sign after a human Wh-question such as WHO?. There were also Unclear utterances (8%), for which the communicative intention was not evident. These consisted for a great part of utterances by Tatu with the sign BLACK. Separating out the unprompted utterances in the corpora (of which there were 522, 18% of the total), the percentage of requests increased to 94%.

The 3,448 utterances consisted of 5,982 times that a chimpanzee made a sign. Of this number, 4,776 times the sign was not imitated from the human. Further analysis of these led to the following information. The five chimpanzees combined used 88 different signs in total, with a mean of 39 signs. Loulis only used four signs (THAT/THERE/YOU, GIMME, CHASE, and HURRY). All chimpanzees had several signs that were used frequently. Three signs (COME/GIMME, FLOWER and GUM) covered almost half of the times that Washoe made a sign. There were ten most frequent signs that took up 60% of the 4,776 times that a sign was made. These were: THAT/THERE/YOU, COME/GIMME, DRINK, FLOWER, FOOD/EAT, SMELL, GUM, TOOTHBRUSH, BRUSH, and HURRY. The semantic categories were restricted mostly to object and action signs (signs for edibles being the biggest category), request markers, and other signs functioning as wild cards, to add emphasis or to please and manipulate the humans into fulfilling their requests

(THAT/THERE/YOU, the chimpanzee's own name sign, and GOOD). Imitation of human signs accounted for 20% of every time that a sign was made. Eighteen percent of the chimpanzee utterances were full or partial imitations. This amount was much lower than the percentages reported for Nim.

Single-sign utterances accounted for 67% of the total, and combinations of two or more signs for 33%. There was no clear evidence for semantic relations in the two-sign combinations, though combinations with THAT/THERE/YOU appeared to indicate that the human should carry out an action or to specify the location of a requested object or action. Longer combinations did not provide more information and showed a great deal of repetition and redundancy, as well as stringing multiple object and action signs together with the wild card signs THAT/THERE/YOU, the chimpanzee's own name sign and GOOD. There was a considerable overlap between utterances of different lengths. A clear order pattern was found in two- and three-sign combinations: object and action signs were more frequent in the initial position while request markers and the signs THAT/THERE/YOU and GOOD appeared more frequently in final position. However, this order preference was not syntactic, but can be interpreted as the expression of an acquisitive motivation.

Chapter 5: Discussion consists of four different parts. In *Part I. The results and their interpretation* the major patterns and phenomena of the chimpanzees' signing behaviour in the recent corpora are listed and discussed. The results on the frequencies of the individual signs that the chimpanzees used mean that there was a skewed use of the signs in their vocabulary. These data are similar to Nim's use of signs. He too mainly used object and action signs and request markers, and seven wild card signs accounted for almost half of the times he used a sign. There was no apparent semantic or syntactic structure in the combinations of signs from the recent corpora. Again, this finding is more in agreement with Nim's ways of combining signs than that it is similar to the reported combining of these same chimpanzee subjects in earlier days. The discourse of the sign interactions was manipulative

rather than conversationally appropriate, on the part of the chimpanzees. Routine question-answer interactions were part of the signing sessions between humans and chimpanzees. The amount of imitation was much lower than that reported for Nim. The signing of the chimpanzees in the recent corpora is thus more spontaneous than Terrace's concluded for the signing apes. This does not mean that it is therefore closer to language, because the chimpanzees may simply consider the signs as useful instruments to get from the humans what they want. The recent data on communicative intentions confirm Terrace's description of chimpanzee signing as being acquisitive in nature. The chimpanzees made specific requests, but also produced structureless strings of signs containing multiple signs for objects and actions and the mentioned wild cards. In these latter cases the chimpanzees appeared to follow a strategy of using many signs in order to influence the human into giving them something. Such utterances appeared to indicate an element of frustration when earlier requests had not been fulfilled immediately, which frustration sometimes also was evident in their nonverbal behaviour. Though most of the naming utterances followed a prompt from the human, the naming behaviour of the chimpanzees, especially of Tatu, remains an interesting area of research for the future. Tatu's use of the sign BLACK was found to be a consistently recurring phenomenon in several corpora. There also appears to be a connection with the regurgitation of food as she often signed BLACK in such circumstances. Though it is unclear what she means when she uses it, there must be a positive motivation to produce the sign that often. Taking all of these results into account, the signing in the recent corpora show a great similarity with the signing of Nim and a strongly different use of signs than the early language of human children. It may be that the signs function like symbols, but there are no other clear similarities with language. With a definition of language that includes the combinatorial properties of signs, the conclusion on the chimpanzee signing in the recent corpora has to be that this cannot be characterized as linguistic. The signs function instrumentally to acquire things rather than that the chimpanzees' sign use shows the many

other functions of language. The chimpanzees have not grasped signing as language, but use it for their own communicative purposes.

The signing of the chimpanzees in the recent corpora is quite different from their reported earlier sign use. Because of the problems of method and interpretation that the earlier research had suffered from, the question comes up in what way this recent signing may be characteristic of the earlier signing as well. Though this study cannot disprove the earlier descriptions, it certainly does not confirm them. The results of this study have to be incorporated into a longitudinal picture of the chimpanzees' signing behaviour throughout the years. The increased captivity of the five chimpanzees may have caused a decrease of linguistic abilities and an increase of acquisitive signing. However, in humans it is not known that linguistic abilities can show a decline once they have been acquired.

The next part of chapter 5, *Part II. The status of the signs: Symbols or conditioned responses?* deals with the question of the status of the chimpanzee signs. This is addressed by comparing their nature to the three types of signs that the philosopher Charles Sanders Peirce distinguished: the icon, the index, and the symbol. There is no evidence in the signing chimpanzees data that their signs function like symbols that refer to things in the outside world. They may well function at an indexical, associative level, being conditioned responses connected to stimuli. However, other research has demonstrated that chimpanzees have a capacity for symbolic communication, especially the work by the Rumbaughs on the chimpanzees Sherman and Austin. It may therefore not be ruled out that the chimpanzee signs also function like symbols.

Chapter 5's next part is *Part III. The chimpanzee sign use compared to the use of lexigrams by the bonobo Kanzi.* This includes a summary of the main research with the bonobo or pygmy chimpanzee Kanzi, studied by the Rumbaughs at the Language Research Center of Georgia State University in Atlanta. He and several other bonobos learned lexigrams, geometric designs arranged on a board or computer screen, to communicate with

humans. Analysis of a large corpus of Kanzi's utterances showed that only 10% were combinations, which is much lower than the 33% found in this study on the recent chimpanzee signing. Kanzi's Mean Lenght of Utterances (MLU) was 1.15 at the age of five, which remained the same for at least the three following years. This compares to Nim's small MLU that stayed the same during the last 1.5 years of Project Nim. The imitation percentages for Kanzi are much lower than that of the signing chimpanzees in the recent corpora, though his half-sister Mulika's percentage is similar. In terms of communicative intentions, Kanzi shows a similar acquisitive motivation as the signing chimpanzees: 96% of his lexigram utterances were interpreted to be requests. Savage-Rumbaugh has claimed that Kanzi's combinations show semantic relations and that he had several preferences in lexigram order (which may not necessarily be evidence for syntax). However, these claims had some problems and were not based on data that were filmed as a permanent record. A future study with filmed records should still confirm these conclusions. In comparison, then, there are no reliable reports that Kanzi's use of lexigrams goes beyond the sign use of the chimpanzees. However, Kanzi's comprehension of English has also been studied. This demonstrated that Kanzi understands a considerable amount of individual English words. There is also some suggestion that he comprehends some grammar, in the form of understanding pairs of sentences with reversed word order. The work with Kanzi shows that more can still be learned from the nonhuman great apes with regards to their linguistic competence and abilities. The book on the subject should not be closed and new discoveries may lay ahead.

Chapter 5 finishes with *Part IV. Suggestions for future research.* In order to replicate the findings of this study on the recent signing of the chimpanzees and to possibly find further phenomena it is recommended that a similar study should be carried out on an annual basis. The fact that the CHCI chimpanzees are the only chimpanzees at a university in existence that still use signs in and of itself justifies such a regular study. Analysis of older corpora would also provide invaluable material. Several suggestions are made for future

studies on specific aspects of the chimpanzee signs use. More analyses of the current corpora could also be done and comparisons with the signing gorillas Koko and Michael and the signing orangutan Chantek should be made.

In the *Epilogue* of this dissertation several scientific speculations and moral implications of this study are discussed. It seems that the signing behaviour of apes does not provide an additional avenue of information on animal consciousness. Humans appear to have a higher degree of specificity in their communication about internal states than chimpanzees. Humans also appear to have a greater variety of communicative intentions in their symbolic communication than chimpanzees. It appears to be the case that once chimpanzees have learned symbols they limit their use to the service of an acquisitive motivation. The moral issues of research with signing apes are next presented. The ape subjects were used in this type of research without their consent. All subjects eventually had to be put in full captivity, robbing them of their autonomy and making them almost totally dependent on humans. Furthermore, multiple moral problems exist in the way in which the chimpanzee subjects were obtained (captured in the wild or taken away from their mother only days after birth), the kind of treatment they received in the projects (housing problems, multiple moves) and in their fate after the end of the projects (multiple signing chimpanzees ended up in biomedical laboratories). The Fouts and their assistants deserve special credit for their lifelong dedication to the fate and welfare of the chimpanzees in their custody. They have also spoken out for the fate and treatment of chimpanzees in general. They argue against keeping chimpanzees in captivity. If it was possible to turn back the clock, the Fouts would now consider it unethical to start projects with signing chimpanzees. It is also the author's opinion that no new projects with signing apes should be set up. The moral implications of the results of this study on the chimpanzees' recent signing behaviour are also discussed. If the signing behaviour of nonhuman great apes cannot be characterized as language, in a utilitarian framework these apes' interests would be fewer than those of language using

humans. In a deontological framework the absence of linguistic abilities could be irrelevant. In the author's opinion the presence of phenomenal consciousness is a sufficient condition for the recognition of an individual's inherent value and egalitarian treatment. Differences in psychological complexity do not justify differences in treatment. Egalitarianism among all animals is still called for.

SAMENVATTING

GIMME GIMME GIMME

Het recente gebruik van gebaren door chimpansees (*Pan troglodytes*) in interacties met bekende menselijke communicatiepartners.

Dit proefschrift beschrijft het onderzoek naar het gebruik van door mensen aangeleerde gebaren door chimpansees en bevat de beschrijving van een studie die werd uitgevoerd om het recente gebruik van deze gebaren door vijf gebarende chimpansees, Washoe, Moja, Tatu, Dar en Loulis, te analyseren.

In *Hoofdstuk 1: Gebarentaalonderzoek met chimpansees* wordt een uitgebreide introductie gegeven van de verschillende projecten met gebarende chimpansees. Door de eeuwen heen hebben wetenschappers en filosofen zich afgevraagd of niet-menselijke dieren, en in het bijzonder niet-menselijke grote mensapen, de naaste dierlijke familie van mensen, in staat waren om een menselijke taal te leren en door middel daarvan hun gedachten en gevoelens konden uitdrukken. In de 20ste eeuw werden enkele pogingen gedaan om chimpansees een gesproken taal te leren. Deze waren niet succesvol. De grootste prestatie was die van de chimpansee Viki (bestudeerd door Keith en Catherine Hayes), die met grote moeite vier woorden kon produceren (*mama, papa, cup* and *up*). Dit gebrek aan succes leidde tot het idee dat niet-menselijke grote mensapen niet in staat waren tot het leren van een

menselijke taal. (Neuro)anatomische verschillen tussen mensen en andere mensapen zijn gesuggereerd als de verklaring voor de mislukking van deze gesproken taal experimenten.

In de jaren 60 van de vorige eeuw, echter, kreeg een echtpaar van (behavioristische) psychologen, Allen en Beatrice Gardner, van de Universiteit van Nevada in Reno, het geniale idee om een visuele gebarentaal te gebruiken in plaats van een auditieve gesproken taal. Zij begonnen chimpansees hand gebaren te leren in plaats van gesproken woorden. De manuele vaardigheid van chimpansees en hun natuurlijke gebruik van communicatieve gebaren suggereerde dat het mogelijk was voor hen om gebaren te leren. In juni 1966 verkregen de Gardners een jonge chimpansee, die tussen de 8 en 14 maanden oud was, noemden haar Washoe, en begonnen haar gebaren te leren. Dit was het begin van Project Washoe, dat vier jaar en drie maanden zou duren (tot oktober 1970). Washoe was gehuisvest in een wooncaravan in de achtertuin van de Gardners. Ze werd "cross-fostered" door de Gardners en hun team, dat wil zeggen, ze werd opgevoed op een manier die zo gelijk mogelijk was aan die van een kind in een menselijk huishouden. Washoe kreeg kleren aan en werd onderworpen aan discipline en aktiviteiten zoals tandenpoetsen. Ze leerde eten met vork en lepel terwijl ze in een kinderstoel zat met een slabbetje om haar nek. Ze kreeg objecten die kinderen krijgen wanneer ze jong zijn, zoals speelgoed, plaatjesboeken en tijdschriften. De mensen in het project speelden ook veel verschillende spelletjes met Washoe, zoals achtervolgings-spelletjes (chase) en verstoppertje. Ze werd ook mee op uitstapjes genomen, zoals bezoekjes aan het bos. Dit kruis-opvoeden (cross-fostering) werd uitgevoerd om te zien op welke manier omgevingscondities invloed hebben op gedrag. De Gardners wilden ontdekken in welke mate een chimpansee menselijk gedrag kon verkrijgen. Zij zagen taal als een aspect van dat gedrag. Als onderdeel van deze opvoeding werd Washoe gebaren geleerd, waarvan de meerderheid was gebaseerd op gebaren uit de Amerikaanse gebarentaal (ASL). De mensen in het project gebaarden over alles wat er gebeurde. Om Washoe de gebaren te leren werd gebruik gemaakt van een mengeling aan methoden, variërend van het geven van

beloningen tot eenvoudig modelleren (waarbij de mensen laten zien hoe het gebaar wordt gemaakt). Het vormen van de handen bleek de meest effectieve methode te zijn. Binnen deze procedure namen de mensen de handen van de chimpansee en vormden deze in de correcte configuratie, brachten ze door de juiste beweging, en leidden de handen naar de correcte plaats van het gebaar dat ze aan het leren waren.

Project Washoe was een groot succes. Aan het einde van het project had Washoe 132 gebaren geleerd. Dit succes inspireerde andere projecten waarin gebaren werden geleerd aan gorilla's (Koko en Michael, onderzocht door Francine Patterson) en een orang-oetan (Chantek, bestudeerd door Lyn Miles). Het is ook van grote invloed geweest voor het werk van Duane Rumbaugh en Sue Savage-Rumbaugh met zowel gewone chimpansees (Sherman en Austin) als bonobo's (Kanzi en anderen). Voor het hele onderzoeksgebied naar apetaal is Project Washoe van uiterst belang geweest.

Een tweede project werd vervolgens uitgevoerd door de Gardners, deze keer met vier pasgeboren chimpansees: Moja, Pili, Tatu, and Dar. Vergelijkbaar met Washoe, werden deze vier chimpansees ook kruis-opgevoed en gebaren geleerd. Zij waren ook succesvol in het leren van gebaren en men zag ze zelfs met elkaar deze gebaren gebruiken. In de tussentijd zette Roger Fouts, een doctoraalstudent van de Gardners die deel uitmaakte van Project Washoe sinds 1967, samen met zijn vrouw Deborah, het onderzoek met Washoe voort. Ze brachten haar in 1970 naar het Institute for Primate Studies van de Universiteit van Oklahoma in Norman. Fouts leerde ook enkele andere chimpansees in dit instituut een aantal gebaren en analyseerde het gebruik van gebaren wanneer de chimpansees met elkaar communiceerden. In 1979 zetten de Fouts Project Loulis op. Loulis was een 10 maanden oude mannelijke chimpansee die geadopteerd werd door Washoe. Vanaf zijn aankomst in het instituut gebruikten de mensen alleen zeven gebaren en gesproken Engels in zijn aanwezigheid. Zij gingen hiermee door voor meer dan vijf jaar, aan het eind waarvan Loulis een vocabulaire van 51 gebaren had geleerd. De meeste van deze gebaren waren verkregen

door middel van observationeel leren, maar er waren ook een paar observaties waarin Washoe Loulis aktief aan het leren was. De Fouts interpreteerden de resultaten van hun project als bewijs voor culturele overdracht van een menselijke taal door chimpansees.

In 1980 verhuisden de Fouts en hun chimpansees naar de Central Washington Universiteit in Ellensburg, Washington. In 1993 zetten zij daar het Chimpanzee and Human Communication Institute op, dat verbeterde levensomstandigheden voor de chimpansees mogelijk maakte. Zij gingen door met het onderzoek naar het gebaren van Washoe en Loulis, als ook van Moja, Tatu en Dar (die naar de Fouts waren gestuurd toen het tweede project van de Gardners was beëindigd).

Een ander project waarin gebaren aan een chimpansee werden geleerd was opgezet door Herbert Terrace, een psycholoog van de Columbia Universiteit in New York. Hij begon Project Nim, met de chimpansee Nim Chimpsky (genoemd naar de beroemde taalkundige Noam Chomsky). Het vond plaats van 1973 tot 1977. Terrace was begonnen met dezelfde hoop en enthousiasme van die tijd. Zijn belangrijkste doel was het verzamelen van een groot corpus aan gebarenuitingen om te analyseren of een chimpansee in staat was tot het produceren van echte zinnen, dat wil zeggen, uitingen met een structuur die door grammaticale regels wordt bepaald. Alleen dan zou Terrace het gebaren zien als voortkomend uit linguistische competentie. Honden en andere dieren kunnen individuele willekeurige gebaren of woorden leren om beloningen mee te verkrijgen, maar dat vermogen moet niet met taal verward worden. Project Nim gebruikte vergelijkbare methoden aan die van de Gardners. Nim leerde 125 gebaren. Aan het eind van het project maakte Terrace uitgebreide discours analyses van op video opgenomen interacties tussen Nim en mensen. Deze en andere resultaten leidde tot behoorlijk verschillende conclusies over het gebruik van gebaren door chimpansees dan die van de Gardners en Fouts. Dit verschil in mening tussen de twee teams (dat van de Gardners/Fouts en dat van Terrace en zijn collega's) leidde tot een

debat over het gebaren van chimpansees en andere apen dat bekend is geworden als de apetaalcontroverse.

Na deze introductie van de twee teams van onderzoekers naar het gebaren van chimpansees, geeft *Hoofdstuk 2: De resultaten van de projecten met gebarende chimpansees* een uitgebreide presentatie van de resultaten van hun onderzoek. Deze resultaten worden gepresenteerd volgens de belangrijkste aspecten van het gebaren. Sectie *2.1. Gebaren*, gaat over de individuele gebaren. De acquisitie criteria voor deze gebaren worden gepresenteerd. Elk chimpansee gebaar kreeg een gloss die het beste Engelse woord benaderde om het gebruik van het gebaar mee te beschrijven. Een gebaar dat bijvoorbeeld werd gebruikt om te verwijzen naar een appel kreeg de gloss APPLE (de gloss van gebaren wordt per conventie in hoofdletters geschreven). Verschillende classificatie methodes werden gebruikt om de semantische categoriëen te bepaelen van de chimpansee gebaren. Een daarvan was een dubbel-blinde procedure om object gebaren mee te testen, die werd gebruikt door de Gardners. Beide onderzoeksteams waren het erover eens dat de chimpansees gebaren hadden verkregen in de volgende semantische categoriëen: objecten, acties, names, persoonstermen, locaties, kleuren, kwaliteiten, verzoek markers (request markers), en eigenschappen (traits). Volgens de Gardners hadden hun chimpansees bovendien gebaren geleerd in de categoriëen algemene namen, bezittelijke woorden (possessives), materialen, kwantitatieven (quantitatives), comparatieven (comparatives), en bepaalde vraag gebaren. Ze beweerden ook dat er een opvallende overeenkomst in inhoud was tussen de chimpansee vocabulaires en de vroege vocabulaires van menselijke kinderen. De gepubliceerde informatie over de frequentie waarmee de individuele gebaren werden gebruikt wordt als volgende gepresenteerd. Het Terrace team vond dat Nim zijn vocabulaire scheef (skewed) gebruikte: enkele gebaren werden erg vaak gemaakt (NIM, ME, YOU, EAT, DRINK, MORE en GIVE) terwijl andere gebaren slechts infrequent voorkwamen. Deze frequente gebaren werden daarom 'wild card' of 'joker' gebaren genoemd, gebaren die geschikt zijn binnen vrijwel elke context. De

Gardners publiceerden minder uitgebreid over de frequentie waarmee de chimpansees hun gebaren gebruikten. De Fouts publiceerden meer details over frequentie in hun analyse van Project Loulis en de twee studies naar het privé gebaren. Alle gebarende chimpansees hadden een aantal gebaren die vaak werden gebruikt.

Sectie *2.2. Combinaties* behandelt de combinaties van gebaren die de chimpansees maakten. Snel na het verwerven van hun eerste gebaren begonnen de chimpansees deze te combineren in meervoudige gebaren uitingen. Terrace berekende de Mean Length of Utterances (de gemiddelde uitingslengte) van Nim en vond dat deze niet toenam met de tijd. Deze bleef tussen 1,1 en 1,6 in de laatste anderhalf jaar van het project. De twee-gebaren combinaties die de chimpansees produceerden werden geanalyseerd op de aanwezigheid van semantische relaties. In een semantische relatie heeft elk gebaar een specifieke semantische rol en de twee gebaren drukken een betekenisvolle relatie uit, zoals actor+actie (TATU DRINK), object+actie (BALL CATCH) en attributie (BLACK HAT). Volgens de Gardners en Fouts waren semantische relaties aanwezig in de chimpansee combinaties, soms zelfs voor 78 tot 90%. Terrace en zijn collega's leken in het begin ook semantische relaties in Nim's 2-gebaren combinaties te hebben gevonden. Echter, zij werden skeptisch over deze conclusie, omdat Nim alleen een kleine variëteit aan gebaren voor de semantische rollen gebruikte. Bijvoorbeeld, negentig procent van zijn locatie combinaties bevatten alleen het locatieve gebaar POINT. Van groter belang was het feit dat het Terrace team, na analyse van gefilmde combinaties, ontdekte dat imitatie een belangrijke rol speelde in het gebaren van de chimpansee. Door mensen te imiteren kon Nim uitingen produceren die een "semantic relational look" hadden, maar die in feite zonder structuur waren. Terrace en zijn collega's concludeerden dat er geen bewijs was voor semantische relaties. De Gardners en Fouts beweerden verder dat de chimpansees creatief nieuwe combinaties produceerden om objecten te beschrijven waarvoor zij nog geen gebaar hadden geleerd. Het beroemdste voorbeeld daarvan was Washoe's beschrijving van een zwaan als WATER BIRD. Terrace en zijn team,

echter, interpreteerden deze speciale combinaties als reeksen van gebaren die ieder op zich relevant waren voor de situatie, maar die niet verbonden waren met elkaar. Zij suggereerden ook dat wanneer de chimpansees op toevallige wijze gebaren combineren, sommige daarvan uiteindelijk lijken alsof ze creatieve betekenisvolle combinaties zijn. Het volgende onderwerp dat werd geanalyseerd op het gebied van de chimpansee combinaties was de mogelijke aanwezigheid van een grammaticale structuur in de vorm van voorkeuren in gebarenvolgorde. De Gardners vonden enkele voorkeuren voor volgorde, maar waren eerst voorzichtig om deze te interpreteren als bewijs voor syntactische regels. De voorkeuren zouden kunnen zijn ontstaan als semantische gewoontes of door imitatie van mensen. Vanaf 1978, echter, interpreteerden de Gardners en Fouts de voorkeuren in volgorde als grammaticale regels. Terrace vond ook enkele regelmatigheden in gebarenvolgorde in Nim's combinaties, maar omdat deze werden gevonden bij uitingen die niet waren gefilmd, maakte de mogelijke rol van imitatie het onverantwoord om deze als syntactisch van aard te interpreteren. Met betrekking tot meervoudige gebaren uitingen van drie of meer gebaren concludeerden de Gardners en Fouts dat naarmate de uitingen in lengte toenamen ook de inhoudelijke informatie toenam. Terrace echter, vond dat Nim's langere combinaties niet een dergelijke toename in informatie lieten zien. In plaats daarvan was er een grote overlap in inhoud tussen combinaties van verschillende lengte. Nim's meervoudige gebaren combinaties vertoonden frequente herhaling (NIM EAT NIM) en redundantie (het gebaar NIM toevoegen aan een sequentie die al het gebaar ME bevat). Hij reeg ook object en actie gebaren met de bovengenoemde wild card gebaren aan elkaar. Nim's langste combinatie, van 16 gebaren, was: GIVE ORANGE ME GIVE EAT ORANGE ME EAT ORANGE GIVE ME EAT ORANGE GIVE ME YOU. Dit rijgen van onsamenhangende gebaren suggereerde een pragmatische strategie van de gebarende chimpansees die eruit bestond meer gebaren te produceren om de kans te vergroten om iets te verkrijgen van de mensen.

In sectie *2.3. Discours en conversationele vaardigheden* worden de resultaten over discours fenomenen en conversationale vaardigheden gepresenteerd. Terrace's discours analyse van op video opgenomen mens-chimpansee interacties liet enkele onverwachte fenomen zien. Slechts 13% van Nim's uitingen waren spontaan, dat wil zeggen, werden niet voorafgegaan door een menselijke uiting. Dit leidde Terrace ertoe om het gebaren door apen als niet-spontaan te kenmerken. De Gardners en Fouts definiëerden spontaniteit alleen in relatie tot imitatie en publiceerden dus geen vergelijkbare gegevens. Wat betreft het initiëren van de gebaren interacties rapporteerden de Gardners en Fouts hoge percentages aan spontaan initiëren door de chimpansees, terwijl Terrace vond dat het gebaren het vaakst door de mensen werd geïnitieerd. Een ander resultaat van Terrace's video-analyses was dat Nim een een hoge mate aan interruptie van de mens vertoonde, wat erop wees dat hij de conversationele regels van het om beurten communiceren niet had begrepen. De Gardners en Fouts waren het hier niet mee ons en interpreteerden interruptie als een normaal turn-taking gedrag in gebarentaal. De belangrijkste ontdekking van Terrace's video-analyses was dat Nim's uitingen vaak volledige of gedeeltelijke imitaties van de menselijke gebaren waren. Nim vertoonde imitatie in 39 tot 54% van zijn uitingen, wat veel hoger was dan bij kinderen. De Gardners en Fouts erkenden de aanwezigheid van enige imitatie, maar interpreteerden dit als een pragmatisch instrument om instemming of nadruk mee aan te geven. Ze maakten echter geen vergelijkbare analyses aan die van Terrace, noch gebruikten zij in het begin gefilmd materiaal om de rol van imitatie in het gebaren van hun chimpansees te bepalen. In plaats daarvan bekritiseerden zij de methodes, procedures en design van Project Nim als verantwoordelijk voor de verschillen in resultaten tussen de projecten.

Sectie *2.4. Communicatieve intenties* is gewijd aan de motivatie van de chimpansees om gebaren te gebruiken. Intentioneel communicatief gedrag is aangetroffen bij niet-menselijke grote mensapen. Communicatieve intenties zijn de redenen waarom de chimpansees gebaren uitingen produceren. Terrace en zijn collega's concludeerden dat het

gebaren van apen *acquisitief* van aard was: ze maakten gebaren om begeerde objecten, aktiviteiten en andere dingen van de mensen te verkrijgen. Hoewel Terrace ook zei dat Nim ook objecten en plaatjes benoemde, beschouwde hij die vorm van gebaren als verschillend van dat wat menselijke kinderen doen. Kinderen hebben een intrinsieke motivatie om taal te gebruiken en uiten woorden om aandacht te trekken naar iets enkel omwille daarvan zelf (just for the sake of doing so). Alleen het gebaren van Nim wanneer hij zonder anderen naar plaatjes aan het kijken was zou niet gericht kunnen zijn op het doen van verzoeken. Terrace en collega's wezen er echter op dat de resultaten van de verschillende projecten niet het volledige potentieel aan taal van niet-menselijke grote mensapen zou hoeven weergeven. De Gardners zeiden dat het gebruik van gebaren door chimpansees verder dan het doen van verzoeken ging en dat de chimpansees een intrinsieke motivatie tot het communiceren van informatie bezaten: de chimpansees benoemden, gaven commentaar op gebeurtenissen en stelden vragen. De Fouts betoogden dat het gebaren van chimpansees onderling niet gerelateerd was aan verzoeken maar sociaal gericht was. Zij beweerden ook dat de chimpansees zelfs hun interne toestanden zoals emoties en gevoelens uitdrukten (door gebaren te gebruiken zoals HURT, CRY en FUNNY) en dat ze ook anderen mee beledigden (door ze dingen als DIRTY te noemen). Het privé gebaren van de chimpansees (wanneer ze alleen zijn of niet in communicatie met anderen) werd ook beschouwd als bewijs voor gebaren dat niet over het doen van verzoeken ging.

Hoofdstuk 2 besluit met sectie *2.5. Taal* waarin de mening van de verschillende onderzoekers en andere wetenschappers wordt gegeven met betrekking tot de vraag of het gebaren van de chimpansees vergelijkbaar is met de vroege taal van menselijke kinderen en daarom taal mag worden genoemd. De Gardners en Fouts beweerden dat er veel overeenkomsten waren met menselijke kinderen die taal verwerven. De chimpansees hadden niet alleen gebaren geleerd, maar *gebarentaal*. Het niet erkennen als taal zou niet passen binnen een darwiniaans continuiteits-denken en zou neerkomen op "wetenschappelijke

apartheid." Terrace en zijn team wezen op de grote verschillen die zij hadden gevonden tussen de gebarende apen en taalverwervende kinderen. De gebarende apen hadden slechts een kunstmatige methode geleerd om hun eisen mee te communiceren op een niet-conversationele manier. Het zou in alle opzichten ongerechtvaardigd zijn om het gedrag van de apen taal te noemen.

Het is dus duidelijk dat er grote verschillen zijn tussen de twee teams van wetenschappers die de gebarende chimpansees bestudeerden. Het is moeilijk om conclusies te trekken ten aanzien van deze punten van controverse, omdat sommige gegevens en conclusies lijden aan ernstige problemen in de methodes die waren gebruikt en in de manier waarop sommige resultaten werden geïnterpreteerd. De belangrijkste problemen worden gepresenteerd in *Hoofdstuk 3: Problemen in methode en interpretatie.* In de eerste sectie van dit hoofdstuk, *3.1. Anecdotes en individuele observaties* worden de problemen besproken van het gebruik van individuele observaties als bewijs. De betrouwbaarheid van zulke gegevens is onvoldoende. Fouten in waarneming en in geheugen kunnen makkelijk plaatsvinden bij het rapporteren van individuele observaties van het gebruik van gebaren door de chimpansees. Deze verslagen bevatten ook geen betrouwbare informatie over de menselijke input op het chimpansee gebaren. Er is dientengevolge geen mogelijkheid om de uitingen op imitatie te controleren. Door de afwezigheid van een permanent document zoals film of video is het niet meer mogelijk om de accuratesse van de observaties te verifiëren. Veel gegevens van de projecten waren gebaseerd op dergelijke individuele observaties, waardoor deze een onbetrouwbare bron van informatie vormen. Het Terrace team leerde echter een belangrijke les toen ze het op video gefilmde chimpansee gebaren gingen analyseren. Dit liet andere fenomenen zien dan verwacht (zie boven). Ze beschouwden alle vroegere claims die niet waren gebaseerd op permanente documenten zoals film en video als ongefundeerd. Sinds de vroege jaren '80 begonnen de Fouts gefilmd materiaal te gebruiken als een standaard

procedure van data verzameling, maar zij bleven individueel geobserveerde gebarenuitingen presenteren als betrouwbare verslagen van het gebaren door hun chimpansees.

Sectie *3.2. Corpora* bespreekt het belang van het analyseren en publiceren van voldoende grote corpora van gebruik van gebaren door de chimpansees. Alleen door systematische verzameling en analyse van grote corpora van het gebruik van specifieke gebaren door de chimpansees kunnen oordelen worden geveld over de aard van die gebaren. Dit geldt zowel voor de beweerde betekenis van individuele gebaren als voor de communicaties die in combinaties van gebaren worden uitgedrukt. De WATER BIRD combinatie, bijvoorbeeld, verliest veel van zijn gewicht als Washoe ook veel blijkbaar minder betekenisvolle combinaties maakt zoals WATER BANANA en COOKIE BIRD. De Gardners en Fouts hebben echter gebruik gemaakt van incidentele voorvallen van gebruik van gebaren in hun kenschets van het chimpansee gebruik van gebaren, terwijl ze een systematische analyse verzuimden van grote corpora van de gebaren die in deze incidentele voorbeelden waren gebruikt. Soms werden echter grotere aantallen van het gebruik van gebaren verzameld, vooral in de Wh-question tests. Sommige van deze corpora werden gepubliceerd, maar dit bestond in het algemeen uit het presenteren van percentages en getallen m.b.t. specifieke onderzoeksvragen, terwijl meer gedetailleerde belangrijke informatie, zoals de exacte gebaren en hun frequenties die waren gebruikt, niet gepubliceerd werd (hoewel de studies naar het privé gebaren een goede uitzondering zijn). Mark Seidenberg (van het Terrace team) beschuldigde de Gardners ervan gebruik te maken van wat hij het *consistentie criterium* noemde: het selectief noemen van enkele voorbeelden van gebaren uitingen die consistent lijken te zijn met een linguistische interpretatie zonder verdere publicatie van de complete corpora. Het Terrace team verzamelde verscheidene systematische corpora van duizenden uitingen van Nim, waardoor duidelijke presentaties mogelijk werden met gedetailleerde informatie over de individuele gebaren en combinaties (en hun frequenties) die Nim produceerde.

Sectie *3.3. Drill en menselijk aanzetten tot gebaren* gaat over de rol die drill en het aanzetten tot het maken van gebaren door de mensen in de projecten met gebarende chimpansees. Drill sessies, het gebruik van beloningen, sociale bekrachtigers zoals het prijzen van de chimpansees, bedreigingen als de chimpansees niet mee wilde werken en andere vormen van menselijke dwang tot gebarenproduktie door de chimpansees vonden tot op zekere hoogte plaats in alle projecten. De chimpansee proefpersonen in de projecten werden gedwongen om te gebaren als principe, omdat ze in gevangenschap werden gehouden door de onderzoekers en ze niet om hun toestemming waren gevraagd om mee te doen aan het onderzoek. De mensen stelden de chimpansees ook elke dag veel vragen. Dit kan hebben geleid tot routinematige vraag-antwoord patronen zonder werkelijk begrip van deze vragen, of zonder een intrinsieke motivatie om te antwoorden. Alle vormen van drill en aanzetten tot het maken van gebaren kunnen in het algemeen de intrinsieke motivatie van de chimpansees om gebaren te gebruiken hebben verminderd en extrinsieke motivaties hebben gestimuleerd: gebaren om begeerde objecten en acties te verkrijgen, of om de mensen te plezieren, om hun eis om te gebaren in te willigen en negatieve reakties te voorkomen. Deze situatie maakt het moeilijk om de aard te bepalen van het motivationeel spontane gebruik van gebaren door chimpansees.

In de laatste sectie van hoofdstuk 3, *3.4. Resterende problemen*, worden verdere ernstige problemen gepresenteerd van de projecten met gebarende chimpansees. In de projecten van de Gardners kunnen sommige gebaren betrouwbaar zijn geworden enkel door deze te memoriseren, omdat het leren en testen van gebaren vaak op dezelfde dag plaatsvond. Een ander probleem is dat enkele gebaren erg lijken op natuurlijke communicatieve gebaren van chimpansees (COME/GIMME, HURRY en OPEN), waardoor het gebruik van de aangeleerde gebaren mogelijk verkeerd wordt weergegeven. Een latere methode van de Gardnes voor het bepalen van semantische relaties zonder de uitingen hoeven te interpreteren, hoewel geïntroduceerd om objectief te zijn, kan tot onjuiste categorisatie van

uitingen als voorbeelden van semantische relaties hebben geleid. GUM CHASE, bijvoorbeeld, zou automatisch zijn verwezen naar de object+actie relatie. Dit hoeft echter geen intern verbonden uiting te zijn maar een uitdrukking van een verzoek van de chimpansee om zowel kauwgom te krijgen als een spelletje chase. Enkele discours studies lijden ook aan methodologische problemen. Zo was het feit dat spontane uitingen minder vaak voorkwamen in drill sessies een artefact van het design van deze studies, omdat er nauwelijks mogelijkheden waren voor de chimpansees om te gebaren zonder een voorafgaande menselijke uiting in de drill sessies. Weer andere problemen betreffen de interpretatie van bepaalde gebaren uitingen als de uitdrukking van specifieke communicatieve intenties. Uitingen met vraag modulaties werden geïnterpreteerd als voorbeelden van het stellen van vragen. Echter, er werd geen onderscheid gemaakt tussen het vragen om goederen en diensten en werkelijke verzoeken om informatie. De interpretatie van het onderlinge gebaren van de chimpansees als niet gericht op het doen van verzoeken, negeerde het feit dat deze vorm van gebaren in de meeste gevallen bleek te functioneren als verzoeken om actie, zoals spel. De interpretatie van DIRTY als een belediging wordt minder plausibel wanneer men eraan denkt dat dit luidruchtige gebaar kan fungeren als een aandacht-trekker.

De gepubliceerde gegevens geven dus veel ruimte voor onenigheid en verwarring en kan hebben geleid tot een onnauwkeurige visie op wat er feitelijk gebeurd wanneer de chimpansees gebaren gebruiken. Om deze geschilpunten op te klaren en een nieuw groot corpus aan betrouwbare gegevens te verkrijgen werd een nieuwe studie opgezet door de auteur, met de hulp van de Fouts en hun studenten. Deze studie wordt gepresenteerd in *Hoofdstuk 4: Een studie naar het recente gebruik van gebaren door vijf chimpansees.* In sectie *4.1. Introductie* wordt deze studie voorgesteld. Het was een descriptieve gedragsstudie met twee centrale methodes: het consistente gebruik van video materiaal en de systematische analyse van grote corpora. De studie had de volgende drie onderzoeksvragen:

- Wat voor gebaren worden gebruikt door de chimpansees en wat zijn de mogelijke semantische categoriëen waar deze gebaren toe behoren?
- Wat voor combinaties van gebaren maken de chimpansees en is er enige semantische of grammaticale structuur binnen deze sequenties? Zijn semantische relaties aanwezig en bestaan er voorkeuren voor gebarenvolgorde?
- Wat zijn de communicatieve intenties van de chimpansees wanneer zij de gebaren gebruiken?

Sectie *4.2. Methode* beschrijft in detail de methodologie van deze studie. Vier grote corpora aan recent gebruik van gebaren, daterend uit de periode van 1992 tot 1999, werden geanalyseerd. De corpora bestonden uit relatief ongestructureerde mens-chimpansee interacties met alle vijf chimpansees in het Chimpanzee and Human Communication Institute (CHCI) in Ellensburg: Washoe, Moja, Tatu, Dar en Loulis. De interacties werden gefilmd op verschillende plaatsen binnen de chimpanzee verblijven van het instituut. De vier corpora bestonden uit 22 uur aan videobanden. De gebaren van zowel de mensen als chimpansees in deze op video opgenomen interacties werden opgeschreven, de segmentering van de chimpansee uitingen werd bepaald en elke chimpansee uiting werd gecodeerd op communicatieve intentie.

Sectie *4.3. Resultaten* presenteert de resultaten van dit onderzoek. In de vier corpora maakten de chimpansees een totaal van 3.448 uitingen. Wanneer de uitingen die alleen uit geïmiteerde gebaren bestonden worden weggelaten is het totaal 2.839. De overheersende communicatieve intentie van de chimpansees was het doen van verzoeken: 86% van alle uitingen waren verzoeken om objecten en acties (met een bereik van 63-96% voor de vier corpora). Verzoeken om objecten werden drie maal zo vaak gemaakt als verzoeken om acties. De chimpansees gebruikten de volgende gebaren in verzoeken om objecten: gebaren voor eet- of drinkbare objecten zoals FLOWER (voor eetbare planten), GUM, COFFEE, CHEESE, NUT, DRINK en FOOD/EAT; en gebaren voor objecten zoals TOOTHBRUSH,

SHOE en CLOTHES. In verzoeken om acties gebruikten de chimpansees actie gebaren zoals BRUSH, SMELL (vooral gebruikt om de mensen te vragen hun adem te blazen naar de chimpansee toe), CHASE en PEEKABOO. De communicatieve intentie Benoemen of labelen van objecten en plaatjes kwam ook voor, maar slechts in 2% van alle uitingen, en al deze uitingen behalve twee volgden een vraag of aanzetten van de mens om een object of plaatje te benoemen. De enige andere communicatieve intentie die werd gevonden was Antwoorden (4%), bestaand uit eenvoudige antwoorden op menselijke vragen. In veel van deze antwoorden gebruikten de chimpansees hun eigen naam gebaar na een menselijke vraag zoals WHO?. Er waren ook Onduidelijke uitingen (8%), waarvan de communicatieve intentie niet duidelijk was. Deze bestonden voor een groot deel uit uitingen door Tatu met het gebaar BLACK. Na het apart zetten van de niet door mensen aangezette uitingen in de corpora (waarvan er 522 waren, 18% van het totaal) nam het percentage aan verzoeken toe tot 94%.

De 3.448 uitingen bestonden uit 5.982 maal dat een chimpansee een gebaar maakte. Van dit aantal was 4.776 maal het gebaar niet geïmiteerd van de mens. Verdere analyse van deze gebaren leidde tot de volgende informatie. De vijf chimpansees tezamen gebruikten 88 verschillende gebaren in totaal, met een gemiddelde van 39 gebaren. Loulis gebruikte slechts vier gebaren (THAT/THERE/YOU, GIMME, CHASE, and HURRY). Alle chimpansees hadden enkele gebaren die erg vaak werden gebruikt. Drie gebaren (COME/GIMME, FLOWER en GUM) besloegen bijna de helft van het aantal malen dat Washoe een gebaar maakte. Er waren tien meest frequente gebaren die 60% van de 4.776 malen dat een gebaar werd gemaakt voor hun rekening namen. Deze waren: THAT/THERE/YOU, COME/GIMME, DRINK, FLOWER, FOOD/EAT, SMELL, GUM, TOOTHBRUSH, BRUSH en HURRY. De semantische categoriëen waren beperkt tot vooral object en actie gebaren (gebaren voor eetbare objecten was de grootste categorie), verzoek markers en andere gebaren die fungeerden als wild cards of jokers, om nadruk aan te geven of om de mensen te plezieren en ze zo te manipuleren dat ze de verzoeken inwilligden

(THAT/THERE/YOU, het eigen naam gebaar van de chimpansee en GOOD). Imitatie van menselijke gebaren vond plaats in 20% van alle keren dat een gebaar werd gemaakt. Achttien procent van de chimpansee uitingen waren volledige of gedeeltelijke imitaties. Dit percentage is veel lager dan die van Nim.

Enkelvoudige gebaren uitingen (dus van slechts 1 gebaar) besloegen 67% van het totaal aan uitingen en combinaties van twee en meer gebaren 33%. Er was geen duidelijk bewijs voor de aanwezigheid van semantische relaties in de twee-gebaren combinaties, hoewel combinaties met THAT/THERE/YOU leken aan te geven dat de mens een activiteit moest uitvoeren of de locatie leken aan te geven van een object of actie waar om werd gevraagd. Langere combinaties vertoonden geen toename in informatie en bestonden uit veel herhaling en redundantie, en uit het rijgen van meerdere object en actie gebaren samen met de wild card gebaren THAT/THERE/YOU, het eigen naam gebaar van de chimpansee en GOOD. Er was een behoorlijke overlap tussen uitingen van verschillende lengte. Een duidelijk patroon in gebarenvolgorde werd gevonden in de twee- en drie-gebaren uitingen: object en actie gebaren kwamen vaker voor in de eerste positie terwijl verzoek markers en de gebaren THAT/THERE/YOU en GOOD vaker voorkwamen in de laatste positie. Deze voorkeur in volgorde was echter niet syntactisch van aard, maar kan worden geïnterpreteerd als de expressie van een acquisitieve motivatie.

Hoofdstuk 5: Discussie bestaat uit vier verschillende delen. In *Deel I. De resultaten en hun interpretatie* worden de voornaamste patronen en fenomenen van het gebruik van gebaren door de chimpansees in de recente corpora opgenoemd en besproken. De resultaten over de frequenties waarmee de individuele gebaren werden gebruikt betekenen dat er een scheef gebruik was de gebaren in hun vocabulaire. Deze gegevens komen overeen met het gebruik van gebaren door Nim. Ook hij gebruikte voornamelijk object en actie gebaren en verzoek markers en zeven wild card gebaren waren verantwoordelijk voor bijna de helft van het aantal malen dat hij een gebaar gebruikte. Er was geen duidelijke semantische of

syntactische structuur in de combinaties van gebaren uit de recente corpora. Opnieuw zijn deze resultaten meer in overeenstemming met de manieren waarop Nim gebaren combineerde dan dat ze overeenkomen met het gerapporteerde combineren van deze zelfde chimpansees in vroegere tijden. Het discours van de gebaren interacties was eerder manipulatief dan conversationeel geschikt, aan de chimpansee zijde. Routinematige vraag-antwoord interacties maakten deel uit van de gebaren sessies tussen mensen en chimpansees. De mate van imitatie was veel lager dan dat van Nim. Het gebaren van de chimpansees in de recente corpora is daarom meer spontaan dan Terrace's concludeerde voor de gebarende apen. Dit betekent niet dat het daarom dichter bij taal in de buurt komt, omdat de chimpansees eenvoudigweg de gebaren kunnen zien als nuttige instrumenten om van de mensen te verkrijgen wat ze willen. De recente gegevens over communicatieve intenties bevestigen Terrace's beschrijving van het chimpansee gebaren als acquisitief van aard. De chimpansees maakten specifieke verzoeken, maar produceerden ook structuurloze reeksen gebaren bestaande uit meerdere object en actie gebaren en de genoemde wild cards. In deze laatste gevallen leken de chimpansees een strategie te volgen om veel gebaren te gebruiken om de mens te beïnvloeden zodat deze hen iets gaf. Zulke uitingen leken te wijzen op een element van frustratie wanneer eerdere verzoeken niet onmiddelijk waren vervuld. Deze frustratie was soms ook duidelijk in hun nonverbale gedrag. Hoewel de meeste benoemende uitingen een menselijk aanzetten volgden, blijft het benoemende gedrag van de chimpansees, vooral dat van Tatu, een interessant onderzoeksgebied voor de toekomst. Tatu's gebruik van BLACK bleek een consistent terugkerend fenomeen te zijn in verschillende corpora. Er lijkt ook een connectie te zijn met de regurgitatie van voedsel omdat ze vaak BLACK gebaarde onder zulke omstandigheden. Al deze resultaten in beschouwing nemend, vertoont het gebaren in de recente corpora een grote overeenkomst met het gebaren van Nim en een sterk verschillend gebruik van gebaren dan het vroege taalgebruik van menselijke kinderen. De gebaren fungeren mogelijk als symbolen, maar er zijn geen andere duidelijke

overeenkomsten met taal. Binnen een definitie van taal die de combinerende eigenschappen van gebaren omvat moet de conclusie over het chimpansee gebaren in de recente corpora zijn dat dit niet als taal gekenmerkt kan worden. De gebaren functioneren instrumenteel om dingen te verkrijgen en het chimpansee gebaren vertoont niet de vele andere functies van taal. De chimpansees hebben het gebaren niet begrepen als taal, maar gebruiken het voor hun eigen communicatieve doeleinden.

Het gebaren van de chimpansees in de recente corpora is behoorlijk verschillend van het gepubliceerde vroegere gebruik van gebaren. Vanwege de problemen in methode en interpretatie in het vroegere onderzoek komt de vraag op in hoeverre dit recente gebaren ook kenmerkend kan zijn voor het vroegere gebaren. Ook al kan deze studie niet de eerdere beschrijvingen weerleggen, deze worden zeker niet erdoor bevestigd. De resultaten van deze studie moeten worden ingedeeld binnen een longitudinaal beeld van het chimpansee gebruik van gebaren door de jaren heen. De toegenomen gevangenschap van de vijf chimpansees kan een afname van hun linguistische vaardigheden hebben veroorzaakt en een toename van hun acquisitieve gebaren. Echter, bij mensen is het niet bekend dat taalvaardigheden kunnen afnemen nadat ze eenmaal zijn verworven.

Het volgende deel van hoofdstuk 5, *Deel II. De status van de gebaren: symbolen of geconditioneerde responsen?* behandelt de vraag naar de status van de chimpansee gebaren. Deze wordt besproken door een vergelijking van hun aard met de drie types van tekens die de filosoof Charles Sanders Pierce onderscheidde: het icoon, de index en het symbool. Er is geen bewijs in de gegevens over de gebarende chimpansees dat hun gebaren functioneren als symbolen die verwijzen naar dingen in de buitenwereld. Ze kunnen goed functioneren op een associatief, index niveau, en geconditioneerde responsen zijn verbonden met bepaalde stimuli. Ander onderzoek heeft echter aangetoond dat chimpansees het vermogen hebben tot symbolische communicatie, vooral het werk door de Rumbaughs met de chimpansees

Sherman en Austin. Het kan daarom niet worden uitgesloten dat de chimpansee gebaren ook als symbolen fungeren.

Hoofdstuk 5's volgende deel is *Deel III. Het gebruik van gebaren door chimpansees vergeleken met het gebruik van lexigrams door de bonobo Kanzi.* Dit bevat een samenvatting van het belangrijkste onderzoek met de bonobo Kanzi, bestudeerd door de Rumbaughs in het Language Research Center van de Georgia State Universiteit in Atlanta. Hij en enkele andere bonobo's leerden lexigrammen, geometrische plaatjes die op een bord of computerscherm, om met mensen te communiceren. Analyse van een groot corpus aan Kanzi's uitingen liet zien dat slechts 10% combinaties waren, wat veel lager is dan de 33% in deze studie naar het recente chimpansee gebaren. Kanzi's Mean Length of Utterances (MLU) was 1,15 toen hij vijf jaar oud was, en dit getal bleef hetzelfde voor de volgende drie opeenvolgende jaren. Dit is vergelijkbaar met Nim's kleine MLU dat hetzelfde bleef gedurende de laatste anderhalf jaar van Project Nim. De imitatie percentages voor Kanzi zijn veel lager dan die van de gebarende chimpansees in de recente corpora, hoewel het percentage van zijn halfzuster Mulika vergelijkbaar is. Wat betreft communicatieve intenties vertoont Kanzi een vergelijkbare acquisitieve motivatie als die van de gebarende chimpansees: 96% van zijn lexigram uitingen werden geïnterpreteerd als verozeken. Savage-Rumbaugh heeft beweerd dat Kanzi's combinaties semantische relaties vertonen en dat hij enkele voorkeuren in lexigram volgorde heeft (welke niet noodzakelijk als bewijs voor syntax gelden). Echter, deze claims zijn niet zonder hun problemen en werden niet gebaseerd op gegevens die als een permanent document werden gefilmd. Een toekomstige studie met gefilmde gegevens zou deze conclusions moeten bevestigen. Er zijn dus geen betrouwbare gegevens dat het gebruik van lexigrammen door Kanzi verder gaat dan het gebruik van gebaren door chimpansees. Kanzi's begrip van Engels is ook onderzocht. Dit toonde aan dat Kanzi een behoorlijk aantal individuele Engelse woorden begrijpt. Er is ook enige suggestie dat hij enige grammatica begrijpt, in de vorm van begrip van paren zinnen met omgekeerde woord volgorde. Het

onderzoek met Kanzi laat zien dat er nog meer te leren valt over niet-menselijke grote mensapen wat betreft hun taalvaardigheden. Het boek over dit onderwerp moet niet worden gesloten en nieuwe ontdekkingen kunnen nog worden gevonden.

Hoofdstuk 5 eindigt met *Deel IV. Suggesties voor toekomstig onderzoek.* Om de resultaten van deze studie naar het recente gebaren van de chimpansees te repliceren en om mogelijk verdere fenomenen te vinden, wordt aanbevolen dat een vergelijkbare studie jaarlijks wordt uitgevoerd. Het feit dat de CHCI chimpansees de enige overgebleven chimpansees aan een universiteit zijn die nog steeds gebaren gebruiken rechtvaardigd op zichzelf alleen al een dergelijke regelmatige studie. Analyse van oudere corpora zou ook onschatbaar materiaal opleveren. Enkele suggesties voor toekomstige studies naar specifieke aspecten van het chimpansee gebaren worden gedaan. Meer analyses van de huidige corpora kunnen ook nog worden gedaan en vergelijkingen met de gebarende gorilla's Koko en Michael en de gebarende orang-oetan Chantek moeten worden gemaakt.

In de *Epiloog* van deze dissertatie worden enkele wetenschappelijke speculaties en morele implicaties van deze studie besproken. Het lijkt erop dat het gebaren van apen geen nieuwe weg naar informatie over dierlijk bewustzijn oplevert. Mensen lijken een hogere graad aan specificiteit te bezitten in hun communicatie over interne toestanden dan chimpansees. Mensen lijken ook een grotere variëteit aan communicatieve intenties in hun symbolische communicatie te bezitten dan chimpansees. Het lijkt het geval te zijn dat zodra chimpansees symbolen hebben geleerd, zij het gebruik daarvan beperken ten dienste van een acquisitieve motivatie. De morele issues van het onderzoek met gebarende apen worden vervolgens gepresenteerd. De proefapen werden in dit type onderzoek gebruikt zonder hun toestemming. Alle proefpersonen moesten uiteindelijk in volledige gevangenschap worden gehouden, waardoor ze van hun autonomie werden beroofd en ze bijna volledig afhankelijk werden gemaakt van mensen. Bovendien zijn er meerder morele problemen in de manier waarop de chimpansees werden verkregen (gevangen uit het wild or weggehaald bij hun

moeders slechts enkele dagen na geboorte), de soort behandeling die ze kregen in de projecten (huisvestingsproblemen, meerdere verhuizingen) en in hun lot nadat de projecten eindigden (meerdere gebarende chimpansees kwamen in biomedische laboratoria terecht). De Fouts en hun assistenten verdienen speciale eer voor hun levenslange toewijding aan het lot en welzijn van de chimpansees onder hun hoede. Zij hebben zich ook uitgesproken voor het lot en de behandeling van chimpansees in het algemeen. Zij argumenteren tegen het houden van chimpansees in gevangenschap. Als het mogelijk zou zijn de klok terug te draaien, zouden de Fouts het nu immoreel vinden om projecten te beginnen met gebarende chimpansees. Het is ook de auteur zijn mening dat nieuwe projecten met gebarende apen niet moeten worden opgezet. De morele implicaties van de resultaten van deze studie worden ook besproken. Als het gebaren van niet-menselijke grote mensapen niet kan worden gekenmerkt als taal, dan zouden in een utilistisch kader de belangen van deze apen minder dan die van taal gebruikende mensen zijn. In een deontologisch kader zou de afwezigheid van taalvaardigheden irrelevant kunnen zijn. In de opinie van de auteur is de aanwezigheid van fenomenaal bewustzijn een voldoende voorwaarde voor de erkenning van inherente waarde en een egalitaire behandeling. Verschillen in psychologische complexiteit rechtvaardigen geen verschillen in behandeling. Egalitarisme voor alle dieren is nog steeds geboden.

Curriculum Vitae

Esteban Rivas was born in Nijmegen on September 27, 1966 as the second and youngest son of a Spanish immigrant worker and a Dutch teacher. He studied psychology at Nijmegen University (KUN) and Utrecht University (UU). He specialized in theoretical psychology and focused on the subjects of animal consciousness and animal cognition. During this study he visited the signing chimpanzees at the Chimpanzee and Human Communication Institute (CHCI) at Central Washington University, Ellensburg, Washington, for the first time. He wrote his master's thesis *Consciousness in animals* together with his brother Titus. M. Sc. in August 1993. He also studied philosophy, at Nijmegen University and the University of Amsterdam (UvA). There he specialized in ethics, focusing on animal ethics. His master's thesis was called *The animal between hierarchy and equality. An egalitarian critique of hierarchies in animal ethics*. M. A. in June 1993. Since 1993 he has been guest assitant of the Department of Dierproefvraagstukken, first at Leiden University (RUL), now at Utrecht University. From 1994 to 1999 he was assistant in education (aio) at the Philosophy of Science section of the Philosophy Department of Nijmegen University. There he set up a Ph.D. project on the signing of nonhuman great apes. As part of this project he carried out empirical research with the signing chimpanzees Washoe, Moja, Tatu, Dar, and Loulis at the CHCI. He has also visited the signing orangutan Chantek in Atlanta, Georgia, and the Gorilla Foundation in Woodside, California, home of the signing gorilla Koko.

STELLINGEN

Het belangrijkste wat ouders kunnen doen is het erkennen van hun kinderen als individuen met een eigen persoonlijkheid en werkelijkheid. Evenzeer is het belangrijkste wat dieronderzoekers kunnen doen het erkennen van dieren als individuen met een eigen persoonlijkheid en werkelijkheid.

Het verschil op het gebied van symbolische communicatie tussen mensen en de onderzochte apen is dat mensen vooral lullen om het lullen zelf, terwijl apen symbolen vooral gebruiken als een instrument om iets anders mee te verkrijgen.

De weg van het woord behoort ook tot de weg van de daad, maar vindt plaats zonder bloedvergieten en bereikt pas een echte mentaliteitsverandering.

Alle dieren (waaronder dus mensen) die onterecht in gevangenschap zitten wordt hun autonomie ontnomen en moeten onmiddelijk worden bevrijd.

Evenals regimes met mogelijke massavernietigingswapens moeten onderzoeksprojecten naar taal bij niet-menselijke dieren uitputtende inspecties toelaten en volledige openheid van zaken geven.

De vrijheid van het woord in wetenschap en samenleving is de beste garantie voor openheid, waarheid en rechtvaardigheid.

Egalitarisme is in deze tijden van groot belang. Niet alleen voor alle dieren, maar ook voor de multi-culturele samenleving en het staatsbestel.

Het streven naar morele idealen of het veiligstellen van de eigen reputatie kan soms leiden tot het compromitteren van de waarheid en de wetenschappelijke integriteit.

Wetenschap, en met name de de psychologie, is de sleutel tot het vinden van oplossingen voor de problemen tussen mensen, van kleinschalig niveau tot wereldschaal.

Blind fanatisme en gebrek aan openheid en respect jegens eenieder komen zowel voor in religieuze stromingen als in bewegingen die opkomen voor dieren.

Vrijheid in de manier waarop een werknemer zich kleedt en in hoe deze eruit ziet moet een secundaire arbeidsvoorwaarde zijn, vooral binnen ideële instellingen zoals het Anne Frank Huis.

Liefde is de basis voor de menselijke en interspecifieke samenleving.

Het niet tonen van publieke affectie en genegenheid door homo's in gevallen waarin dit wel gebruikelijk is voor hetero's is geen teken van respect voor andersdenkenden, maar van een gebrek aan emancipatie.

Bergwandelingen zoals door Long's Pass in de staat Washington zijn vormen van de puurste filosofie.

De draagtijd van een promovendus is vele malen langer dan 9 maanden.

Stellingen behorende bij het proefschrift

GIMME GIMME GIMME

The recent signing behaviour of chimpanzees (*Pan troglodytes)*

in interactions with longtime human companions

van Esteban Rivas

Nijmegen, 17 april 2003